AN ASSESSMENT OF SEARCH AND RESCUE

FOR EAST COAST OFFSHORE EXPLORATION DRILLING OPERATIONS

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DRAFT

CAUTIONARY NOTE

INTRODUCTION

This report has been prepared for the Royal Commission on the Ocean Ranger Marine Disaster under is Part II mandate which calls for the Commission to investigate into methods whereby the safety of Eastern Canada Offshore Exploraton drilling operations could be improved.

The objective of the study is to critically assess present rescue capabilities and to identify methods whereby rescue capability could be improved. The focus of the study is on the offshore oil and gas industry and as such only that part of the rescue system which could be applied to this industry is discussed. The terms of reference of the study are attached in Annex H.

The study has been divided into four major sections. The first section, Chapter 1, outlines the rescue problem in terms of types of incidents, numbers of persons to be rescued and the anticipated survival time of the survivors of an incident.

The second section, Chapter 2, describes the government SAR system. The responsibilities, objectives and management of the SAR system are outlined with reference to the offshore oil industry.

The potential and historical users of the SAR system are examined nationally and on the East Coast of Canada and the significance of the oil industry as a SAR client is discussed. The deployment of SAR resources is also examined nationally and on the East Coast to determine firstly if the levels of SAR service provided on the East Coast are equitable to those provided in other areas, and secondly to determine if the deployment of resources on the East Coast is suitable to meet the need of all SAR clients, including the offshore oil industry.

The equipment and procedures used by the SAR system and the training given to SAR personnel is described in this section which concludes with a description of the SAR systems in Norway and the United Kingdom.

The third secion descirbes the offshore oil industry search and rescue capability. This section parallels that of the Government SAR system with the responsibilities and management of industry seach and rescue being described. The equipment and procedures used by industry and the rescue training which is given to industry personnel are outlined and the section concludes with a description of oil industry search and rescue in the North Sea.

The fourth section analyses the effectiveness of the combined government and industry search and rescue capability.

The effectiveness of the system is examined relative to the rescue problems outlined and recommendations are made as to how this system can be improved.

The study concludes with a discussion of future developments in search and rescue and the general conclusions which the study group identified during the course of their work.

The study group consisted of individuals from a variety of backgrounds and was lead by Vice-Admiral J.A. Fulton (Ret'd). Vice-Admiral Fulton was the Commander, Maritime Command in Halifax from 1980 to 1983 and in this capacity was responsible for the operation of all DND search and rescue resources in Eastern Canada.

Lt. Colonel J.E. Dardier (Ret'd) provided much of the input into air search and rescue. Lt. Colonel Dardier is a fixed wing and helicopter pilot who was the Commanding Officer of 413 (Rescue) Squadron at CFB Summerside, PEI, from 1972 to 1974. He was involved in the SAR program in Ottawa from 1978 to 1983, his last appointment being that of DND Secretariat Member, Interdepartmental Committee on Search and Rescue.

Input into the marine aspects of search and rescue was provided by Captain I. Green, Captain P. Brick and Captain M. Williamson.

Captain I. Green is the former Regional Manager Fleet Systems (1974 - 1982), Canadian Coast Guard. In this capacity he was responsible for the deployment of icebreakers in the Gulf of St. Lawrence, and for the monitoring of the operation of all ships in the Maritime region.

Captain P. Brick is currently the Marine Superintendent of Naval Auxiliary Vessels in Halifax. He is a sitting member of the Marine Safety Advisory Council (National), the Marine Safety Advisory Council (Maritimes), and on the Committee for Revision of the Canada Shipping Act.

Captain M. Williamson contributed much of the information on industry standby and supply vessels. Captain Williamson is presently president of Craigmore Ofshore Limited. He was the Assistant Marine Superintendent for Petro Canada and has extensive experience as a supply vessel master in the North Sea and in other parts of the world.

Major H. Pullen provided the analysis of the search and rescue statistics. Major Pullen was involved in the development of an information system for Maritime Command while with the Canadian Armed Forces.

The principle on which the study was conducted was to supplement the in-house knowledge of the study group with

detailed literature research and discussions with oil company, supply vessel company, and helicopter company representatives. The Canadian Coast Guard, Department of National Defence, the Interdepartmental Committee on Search and Rescue, COGLA and NLPD were also contacted and provided a great deal of information to the study group. Information on the survival times of persons in the water was developed with the aid of personnel from Memorial University and from the Defence and Civil Institute of Environmental Medicine.

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CHAPTER 1: THE RESCUE PROBLEM

1.1 INTRODUCTION

The increased pace of oil and gas exploration off the East Coast of Canada during the past few years has resulted in a large number of people working in a hazardous environment. In 1983 a total of 17 mobile offshore drilling units (MODUs) operated in this area. These MODUs were supported by some 35 offshore supply vessels and 13 helicopters. This activity has resulted in approximately 1,000 people working offshore in the oil and gas industry at a time.

The number of MODUs, supply vessels and helicopters in use gives rise to concerns as to the capability to effect a rescue should a disaster occur. In order to determine the capabilities for rescue the causes of potential disasters must be examined and the subsequent demands upon the rescue system determined. This chapter discusses the possible scenarios where rescue services will be needed and examines the required rescue capabilities to successfully manage a rescue.

1.2 TYPES OF INCIDENTS

1.2.1 Mobile Offshore Drilling Unit

The circumstances which may require the evacuation of a MODU are numerous and an in-depth discussion of them is outside the

scope of this report. Incidents where evacuation is required are considered here to the extent of the factors which will affect the method and required timing of the rescue effort.

<u>Planned Evacuation</u> - This could occur as a result of a forecast of severe storm conditions, the encroachment of ice or other factors. The decision to evacuate would be made according to preset limits as outlined by the regulatory agencies, the rig owners or the operator. This type of evacuation would take place before the danger to the MODU becomes acute and a time frame of 12 to 18 hours should be available to complete the evacuation. Under these circumstances, there should be no requirement for personnel to evacuate via lifeboats or to have personnel in the water. There may however, be a requirement to transfer personnel to another vessel in the area.

<u>Evacuation with Limited Warning</u> - It is assumed that a limited amount of time (1-2 hours) is available to prepare for the evacuation but that the time available is not sufficient to effect a planned evacuation. This type of evacuation may be required if a planned evacuation is not successful or due to the undetected encroachment of ice, a loss of stability or to other factors. Under these circumstances the personnel will probably be required to evacuate via the lifeboats or transfer to another vessel in the area. The number of personnel who evacuate the rig directly into the water should be small and all should be wearing thermal protection.

Immediate Evacuation - This type of evacuation would be immediate and without forewarning and would probably be the result of a major structural failure, a blowout with fire or some other catastrophic event. There would not be time to organize an orderly evacuation as in the previous scenarios. A large number of people would likely be in the water, some without survival suits, although some personnel may be able to evacuate via lifeboats or liferafts.

The three cases outlined above highlight the scope of the rescue problem when discussing the total evacuation of a MODU. The time span and resources required to effect a successful rescue vary but in general it can be stated that the most severe rescue problem will be that resulting from an immediate evacuation. The presence of large numbers of people in the water whether they have thermal protection or not, will require that a rescue is carried out in a very short time and that considerable resources will be required to meet these time requirements. The rescue effort may also be complicated by environmental conditions such as sea state, wind, etc. or by factors such as fire or flammable gases. Because the location of the MODU is known it is not anticipated that the amount of time required to locate survivors from a MODU will be appreciable.

1.2.2 Supply Vessel

A supply vessel faces the same hazards as other ships at sea

but because of its function there are additional problems which could result in a requirement to evacuate the vessel. For example, the transfer of cargo at sea poses hazards both in danger of collision with the MODU and in ballasting the vessel. The shifting of deck cargo while in transit has presented problems in the past.

The loss of a supply vessel would probably result in an evacuation via the lifeboats and liferafts but the possibility of all personnel being in the water must not be overlooked.

1.2.3 Helicopters

The hazards associated with helicopters in the offshore mainly revolve around a helicopter crash while landing on a MODU and the crash or ditching of a helicopter while in transit.

In the event of a helicopter crash on a rig there is a good possibility that a fire may result and there could be significant damage to the MODU. The rig heliport would likely be unavailable for use in a subsequent rescue.

A helicopter crash or ditching enroute will probably result in the helicopter overturning before the survivors can be evacuated. The evacuation therefore would take place under the water. Passengers should be wearing helicopter immersion suits and would either be in the water or in liferafts.

1.3 THE RESCUE SCENARIO

1.3.1 Survivor States and Numbers

The problem of how to successfully abandon a MODU, supply vessel or helicopter and to survive while awaiting rescue is a very complex issue. The scope of this study precludes an assessment of evacuation systems but instead assumptions will be make as to the rescue problems which will be presented.

If a MODU is abandoned approximately 50 to 100 persons will have to be rescued. This rescue could take several forms:

- dry transfer from the MODU to a shore base or to another vessel;
- rescue from Totally Enclosed Motor Propelled Survival Craft (TEMPSC);
- rescue from inflatable survival craft;
- rescue from the water of a survivor wearing an immersion suit;
- rescue from the water of a survivor not wearing an immersion suit.

Depending upon the type of incident and the amount of time available to carry out the evacuation, survivors from a MODU may be in one or all of these situations.

In the case of an incident involving a supply vessel the same types of rescue situations could be present as with a MODU. The major difference in effecting a rescue from a supply vessel is the numbers of people to be rescued. A supply vessel should have only 12-16 persons which could need to be rescued.

An incident involving a helicopter would likely result in up to 20 persons which will require rescue. In the case of a helicopter ditching or crashing enroute the survivors may be either in inflatable liferafts but more probably will be in the water wearing helicopter immersion suits.

Both the supply vessel sinking and the helicopter crash enroute may result in some time being spent localizing the incident as its exact position may not be known with a high degree of certainty.

The survivors of all incidents may be suffering from injuries as a result of the incident and in all cases where there are people in the water the dangers from drowning and hypothermia necessitate a rescue within a short time frame.

1.3.2 Survivability in Survival Craft

The successful evacuation of personnel from a MODU, supply vessel or helicopter is only the first step in ensuring their ultimate safety. Personnel must be able to survive under severe

conditions until they can be rescued and transported to a safe refuge. The situations that the survivors of an incident will be in following abandonment can be broken down as follows:

- in a Totally Enclosed Motor Propelled Survival Craft (TEMPSC);
- in an inflatable survival craft;
- in the water - with no thermal protection,
  - with a helicopter immersion suit,
  - with an abandonment suit.

TEMPSC - The probability of survival in a TEMPSC assuming that it has been launched in an undamaged condition and that the personnel are properly strapped in is quite high even under severe environmental conditions. Martec Ltd.[1] estimates that survival in a TEMPSC could be reasonably expected up to Sea State 9 and Beaufort Wind Force 12. These scales are included in Annex A.

Hollobone, Hibbert and Associates Limited[2] state that existing TEMPSC can provide for effective survival under the most severe conditions which can be expected off the East Coast of Canada. These conditions, as outlined in the study, are a maximum wave height of 17 meters and winds of 60-70 knots.

The confidence placed upon the ability of these craft to

survive extreme conditions is due in large part to their self righting capability and upon the assumption that they are manned by competent personnel.

In order for the self-righting capability to be retained with any certainty the survivors must be properly strapped in and the TEMPSC must not be flooded internally.

The ability to survive in these craft for extended periods of time will also depend upon other factors. Although TEMPSC are warmed internally by the heat of the engine it may not be possible to run the engine at all times while awaiting rescue. After extended periods of time frost-bite and hypothermia could incapacitate survivors if survival suits or suitable protective clothing is not worn.

A major concern in survival in a TEMPSC is motion sickness. Seasickness results in dehydration which aggravates the onset of hypothermia and shock. As well, sea sickness can result in a dangerous loss of morale which can cause the victim to neglect measures to ensure his own safety.

Although personnel in a TEMPSC may be extremely uncomfortable due to seasickness the craft will offer sufficient protection from hypothermia and drowning. Survival should be possible for about 48 hours. Indeed, attempts to rescue personnel from a TEMPSC may be more dangerous than allowing the personnel

to remain inside.

Hypothermia, frost-bite or seasickness will make the recovery of survivors from a TEMPSC more difficult especially if attempted under conditions which require that the survivors assist in the effort.

<u>Liferafts</u> - The probability of survival in an inflatable liferaft is somewhat less than in a TEMPSC. Liferafts will remain stable and provide quite good protection from drowning assuming that suitable shaped drogues or sea anchors are deployed. Trials of liferafts off Iceland[3] in 1981 proved that they would remain stable in wind speeds gusting to 65 knots and "very rough seas" in excess of 10 metres. Martec Ltd. estimated that survival in a liferaft can be reasonally expected up to Sea State 9 and Beaufort Wind Force 11.

The major concern for survivors in an inflatable liferaft is hypothermia. Some or all of the occupants will probably have entered the liferaft from the water and therefore will be wet and cold initially. The temperature inside liferafts is maintained only by the body heat of the survivors. Although some insulation from the sea is provided by the floor, an ingress of cold by this route is to be expected. Even if the survivors have entered the liferaft dry, hypothermia can be expected to be a problem due to the low sea and ambient temperatures which are present in the study area for most of the year.

As with a TEMPSC, the survivors in a liferaft will probably be suffering from seasickness. The aggravation of the onset of hypothermia due to seasickness becomes more critical for survivors in a liferaft as no external source of heat is present.

Unless survivors are clothed in immersion suits or other suitable thermal protection it is anticpated that a rescue would have to take place very quickly to prevent death from the effects of cold. If suitable thermal protection is worn it is probable that this could be extended.

1.3.3 Survivability of a Person in the Water

The situation of a survivor in the water is the most demanding in terms of rescue. In a sea survival situation, two properties of water dwarf all others. First, water conducts heat away from the body about 25 times faster than air. Second, the volumetric specific heat of water (the amount of heat required to raise the temperature of 1 cc of water by 1°C) is 4,000 times that of air. These two factors combined, spell rapid death for unprotected survivors in cold water. If conditions other than water temperature are ignored, the rate of onset of death is sure and can be predicted with some accuracy.

Sea surface temperature plots for the study area for each month of the year were obtained from the Atmospheric Environment Service. An example, Figure A-1 of Annex A, shows isopleths for the month of January. These charts are based on an eight year data base and are mean contour positions. Considerable year to year variations may occur, particularly along the shelf waters of Nova Scotia and Newfoundland during the summer months, where standard deviations of sea surface temperature may be 3 or 4°C. The -2°C isopleth is not provided.

Before discussing any specific survival time model, it is useful to obtain a qualitative idea of conditions typical of Canadian East Coast Offshore.

Comparison of Canadian East Coast with Other Areas

The U.S. Defense Mapping Agency[4] publishes a world-wide survival time chart for the months of February, May, August and November. Although the model used is not entirely satisfactory for predicting survival time for this study, it is nevertheless valid for comparisons. Areas which compare with the Canadian Offshore are:

1. South Shore of Newfoundland and Nova Scotia
   a) Gulf of Alaska and Aleutians
   b) Northwest Coast of Norway
   c) Cape Horn and Falkland Islands

2. Coasts of Labrador and Northeast Newfoundland
   a) West Coast of Alaska
   b) South Spitzbergen
   c) Murmansk

3. East Coast of Baffin Island
   a) Bering Strait
   b) North Spitzbergen
   c) Antarctic Penninsula

An examination of the monthly pilot charts in the same publication, provides another basis for comparing the Canadian offshore environment with that in the North Sea, as shown below:

	MEAN ANNUAL WIND SPEED	MEAN ANNUAL CALMS (% OF TIME)
North Sea (Northern portion)	23 kph	2.7%
North Sea (Southern portion)	23 kph	2.7%
Labrador Sea	24 kph	2.6%
Hibernia	25 kph	1.5%
Nova Scotia	24 kph	2.3%

NOTE: Northerly limit of charts if 67 N (approximately Cape Dyer); East Coast of Baffin Island is therefore not included.

By comparison with North Sea offshore, the Labrador Sea, Hibernia and the Scotian Shelf all experience higher mean annual wind speeds and fewer calm periods. Hibernia has the least calm weather (1.5% of the time) and the highest mean annual wind speed (25 kph) of any of these areas.

With the exception of the Scotia Shelf and Grand Banks during late summer, East Coast Offshore survival times are significantly shorter than in the North Sea.

Determination of a Survival Time Model

A number of factors affect survival time in water; they include:

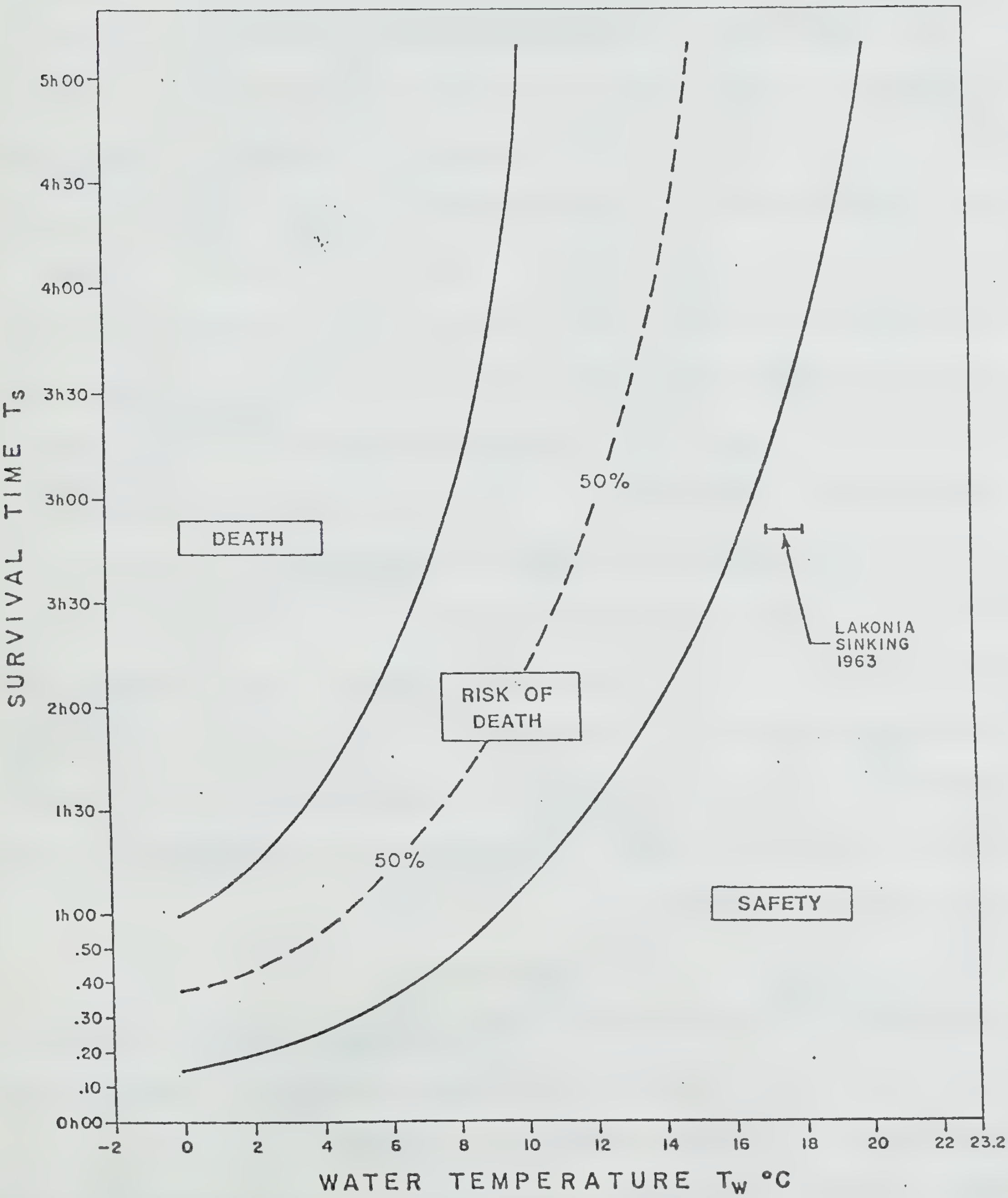
1. The difference in temperature between the water and the survivor.
2. The effect of other environmental factors: sea state, wind speed, air temperature and icing.
3. The condition of the survivor:
   a) physical and psychological;
   b) the degree of protection provided by any special clothing and life preserving equipment.

In recent years, the survival model for clothed persons which has been most widely accepted is based on Molnar's[5] work shown at Figure 1.1. This is derived from U.S. Navy shipwreck data between April 1942 and April 1945. Work by others generally confirms Molnar's findings. In one area, only, is this model inconsistent with subsequent accident data; this is the shipwreck of LAKONIA off Madiera in calm seas, and 17 to 18°C water where the survival rate amongst those unable to board life craft was only 43.5%. The U.S.N. model predicts almost 100% survivors.

Since this model was derived from actual shipwreck data, the probable reason for optimism is a lack of data; the question is: how should the model be modified to bring it close to reality?

FIGURE 1.1

U.S. NAVY SURVIVAL MODEL



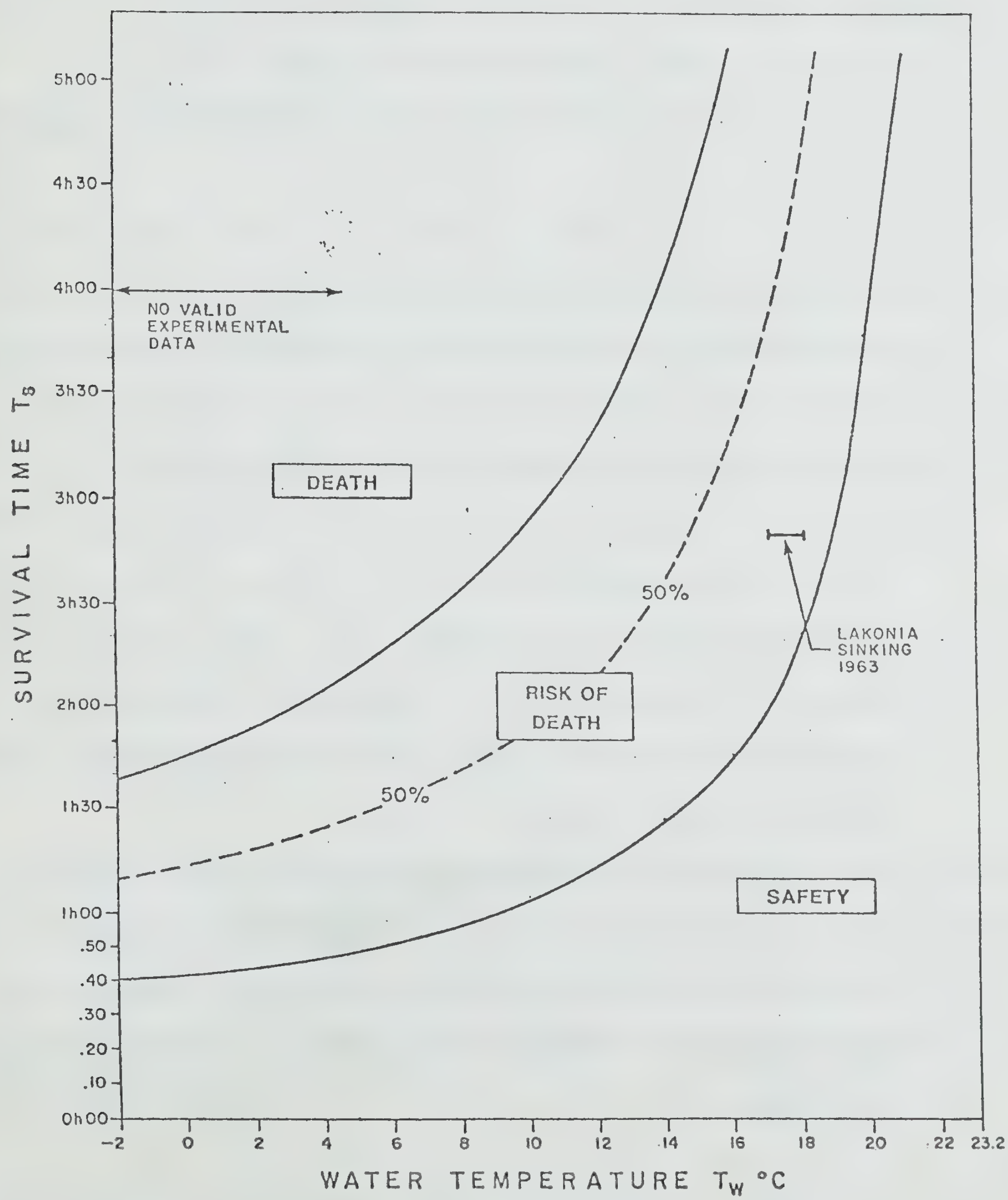
SOURCE : U.S. NAVY SHIPWRECK DATA · APRIL 1942 – APRIL 1945

One possible solution comes from the work on hypothermia by Hayward, Eckerson and Collis[6] of the University of Victoria in 1974. The model they developed involves a prediction formula, based upon experiments with a range of subjects wearing light clothing and flotation, which attempts to exclude all variables but water temperature (in the Straits of Juan de Fuca on days when water temperature was 18.2°C, 10.5°C and 4.6°C) and time. In applying Hayward's prediction to this study, one choice remains: what body core temperature should be selected to represent the boundary between Safety and a Risk of Death? Molnar implies a core temperature of 95F (35°C). Even using young subjects (19-29 years old), Hayward had his subjects leave the water when core temperature fell to 35°C. Medical personnel at Memorial University agree that it is unsafe to permit core temperature in experimental subjects to fall below 35°C. This core temperature was therefore used to calculate the lower boundary and is shown together with Hayward's upper boundary as a survival time model for hypothermia (Figure 1.2).

It is interesting to note that this curve predicts, more correctly, that the passengers and crew of LAKONIA were outside the safety zone. It should be emphasized that Hayward's prediction is for hypothermia; he does not predict death by other mechanisms.

FIGURE 1.2

HYPOTHERMIA SURVIVAL MODEL



SOURCE : HAYWARD'S HYPOTHERMIA PREDICTION FORMULA

A comparison of Hayward's hypothermia prediction curve and Molnar's curve derived from actual deaths in shipwrecks indicates that people tend to die before the oneset of hypothermia, from other causes.

Golden[7] has recently classified these mechanisms or modes of death as follows:

MODE 1	On Initial Immersion - first 2-3 minutes. Cardio-vascular accident or incapacitation resulting in drowning.
MODE 2	Short Term Immersion - 3-15 minutes. Problem of remaining afloat - even competent swimmers find difficulty swimming for 10-15 minutes in very cold water - results in drowning.
MODE 3	Long Term Immersion - 30 minutes and thereafter. Normally death will occur even in those wearing life jackets after a period of time.
MODE 4	Post Immersion - during, or shortly after rescue Some of those rescued alive suffer death, from delayed effects of drowning, rewarming collapse or post-immersion collapse (withdrawal from hydrostatic support).

During rescue, it is important that when the hydrostatic support of the water is eliminated, the extra load on the cardio-vascular system is minimized. For example, survivors should, when possible, be kept horizontal and when not possible (e.g. a helicopter hoist) a double-strop system be used to bring the knees up towards the level of the head.

Golden also draws an important conclusion regarding survival: as the majority of deaths following immersion occur in the early stages, before hypothermia develops, preventative efforts should be directed towards providing protection against the short-term incapacitating effects of cold and protection against drowning.

Snellen and Manson (8) indicate that for search and rescue purposes a survival time (i.e. 50% risk of death) is not very usefull. What is required is a definition of safe time.

The U.S. Navy chart provides a "safe" curve which appears to predict the onset of death for reasons other than hypothermia at low water temperatures (about 10°C or less) but which failed to accurately predict deaths at higher temperatures as evidenced by the Lakonia sinking.

The Hayward curve which was developed for a drop in core temperature to 35°C predicts a more rapid onset of death in water temperatures of above 10°C than the U.S. Navy data and indicates

that the survivors of the Lakonia were indeed at risk from hypothermia. However the Hayward curve does not predict deaths which occur at water temperatures of lower than about 10°C, a prediction which the U.S. Navy model makes based upon actual shipwreck data.

Snellen and Manson indicate that a combination of the U.S. Navy's "safe" curve and the Hayward curve for a drop in body core temperature to 35°C seems to provide an emperical safe time curve. This curve does not take into account individual differences such as subcutaneous fat, body size, clothing, attempts to swim, etc.

Such a composite curve is shown at Figure 1.3 and is used as a basis for predicting survival time for man without a survival suit in this report.

<u>Survival Times, No Survival Suit</u>

In order to develop survival times for the Canadian East Coast Offshore, sea surface temperatures were examined for several points on the Grand Banks and Scotian Shelf (Figure 1.4). Table 1.1 outlines the minimum and maximum mean sea surface temperatures as well as the lowest temperature which could be reasonably expected at these points based upon the water being 4°C colder than the mean temperature. The table also shows the expected survival time, based upon the Canadian Survival Model, of a man in a lifejacket, at the lowest expected temperature and at the highest mean temperature.

FIGURE 1.3

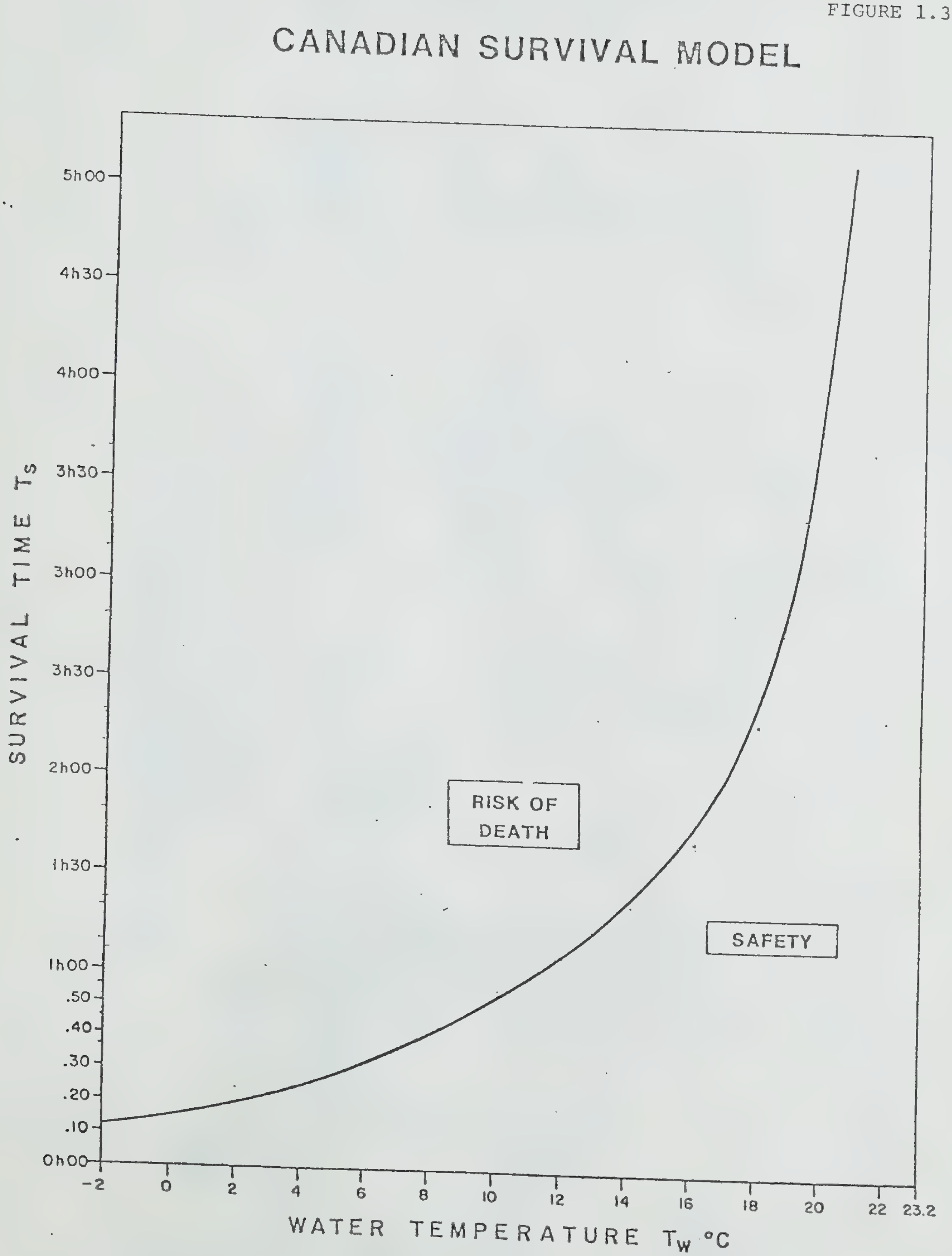

CANADIAN SURVIVAL MODEL
5h00
4h30
4h00
3h30
3h00
3h30
2h00
1h30
1h00
.50
.40
.30
.20
.10
0h00
SURVIVAL TIME T_S
RISK OF DEATH
SAFETY
-2
0
2
4
6
8
10
12
14
16
18
20
22
23.2
WATER TEMPERATURE T_W °C

Figure 1.4

EAST COAST AREA OF OPERATIONS

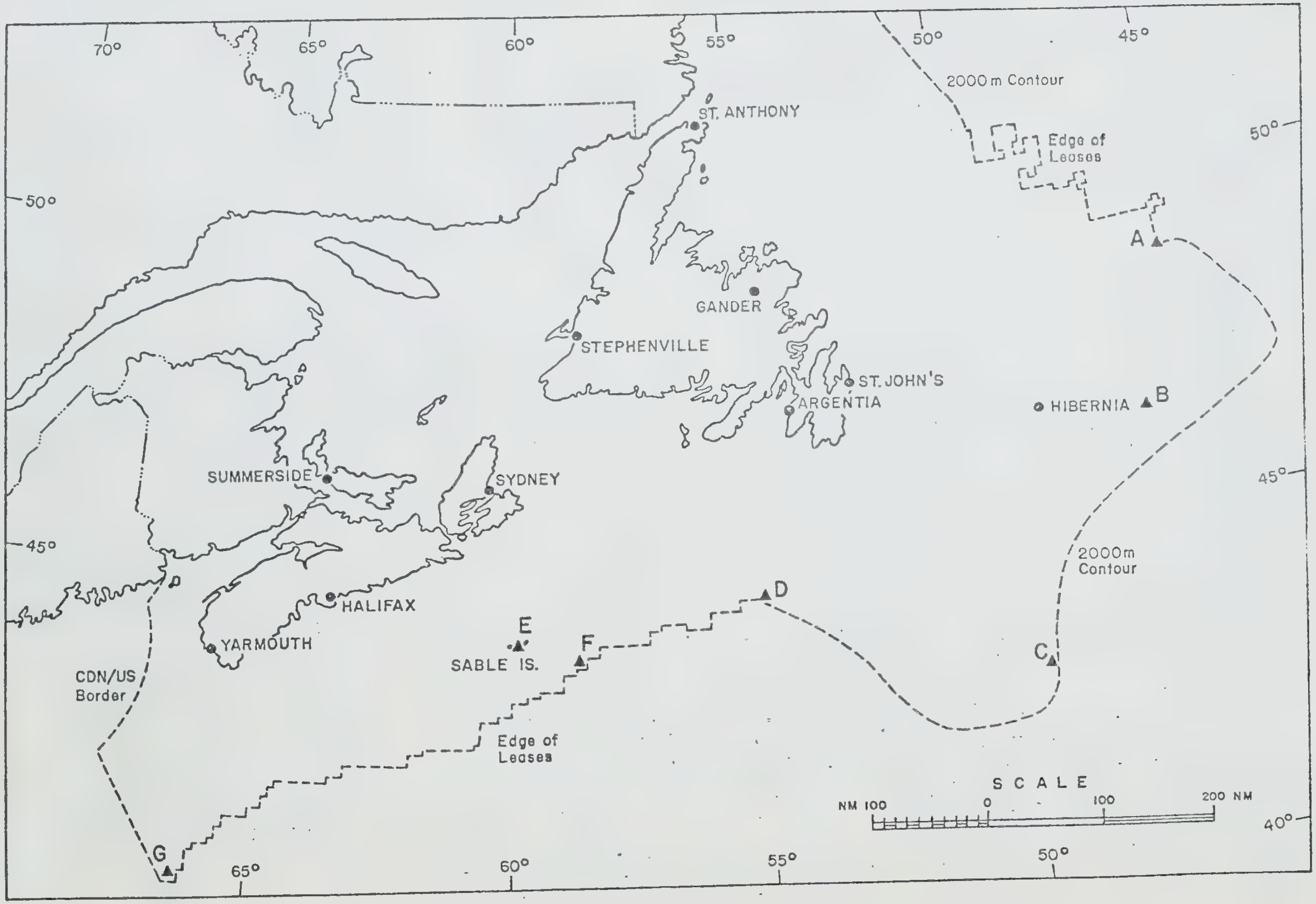


TABLE 1.1

SURVIVAL TIME;
MAN IN THE WATER IN A LIFEJACKET -
NO THERMAL PROTECTION

	Lowest Mean Water Temp.	Lowest Exp. Water Temp.	Highest Mean Water Temp.	Survival Time Lowest Water Temp.	Survival Time Highest Water Temp.
Point A	4.0°C	0°C	13.0°C	0:15	1:15
Point B	3.5°C	-.5°C	14.0°C	0:14	1:25
Hibernia	1.8°C	-1.8°C	13.5°C	0:12	1:20
Point C	6.0°C	2.0°C	19.0°C	0:19	3:00
Point D	3.0°C	-1.0°C	17.5°C	0:13	2:12
Point E	4.0°C	.0°C	18.5°C	0:15	2:42
Point F	4.0°C	.0°C	18.5°C	0:15	2:42
Point G	8.0°C	4.0°C	21.0°C	0:25	4:00+
Hopedale	-1.8°C	-1.8°C	5.0°C	0:12	0:28
Baffin	-1.8°C	-1.8°C	1.0°C	0:12	0:17

The survival times, for a man in a lifejacket in the lowest expected water temperature at each location are essentially the same ranging from 12 to 19 minutes. Survival times at the highest mean temperatures show considerable deviations.

Table A-3 of Annex A shows the monthly mean sea surface temperature at each location and Figures A-2 to A-13 of Annex A show the survival time, based upon the Canadian Survival Model, for a person in the water wearing a lifejacket. These times are based upon the Mean Sea Surface Temperature and do not account for year to year deviations.

Survival Time in an Abandonment Suit

There are no data available, comparable to the U.S. Navy shipwreck data, from which to derive a survival time model for man in an abandonment suit.

An abandonment suit should do two things: protect a survivor from cold and protect from drowning. Some suits on the market perform these tasks reasonably well, others less well. While all incorporate thermal insulation, many provide a poor body position, with little freeboard for the nose and mouth, while others even let a survivor float horizontal with no guarantee that he will not be face down in the water.

The more satisfactory suits support the survivor on his back at an angle of approximately 45°. They give protection against death from early physiological factors (modes 1 to 3), thermal insulation against hypothermia and reasonable freeboard. However, no current suit provides protection from inhalation of foam in a high sea state and wind, which would lead to early drowning. Although preventative work against this hazard is on-going, particularly in the U.K., it's effect is currently unpredictable. Survival time in an abandonment suit will therefore be addressed without reference to early drowning from foam inhalation and as the suits provide protection from death in modes 1 and 2, it will be based in this study upon time to onset of hypothermia, corresponding to a drop in body core temperature to 35°C.

There exists a Canadian Standard (CSGB 65-GP-16MP) for abandonment suits. Canadian Coast Guard requires that all abandonment suits which are used on MODUs or supply vessels must meet this standard prior to being approved for use. The standard is included in Annex B. The standards for abandonment suits includes a requirement that the suit must provide thermal protection such that the average body core temperature of persons wearing the suit for 6 hours in calm circulating water that is between 0°C and 2°C shall not drop more than 2°C and the average finger or toe skin temperature of the wearers shall not drop to less than 5°C in a thermal protection test.

The standard also outlines the methodology for the thermal protection test. This is contained in Annex B.

Abandonment suits currently used in the offshore include models manufactured by Imperial (1409), Seawolf (1, 2 & 3), Helly-Hansen, Narwhal, Fitzwright and Bayley. All have been tested against the above standard specification and are approved by Canadian Coast Guard.

The standard itself is open to critisism since it does not take into account weather and sea conditions that frequently exist. Work is currently going on in conjunction with the Canadian General Standards Board to improve the standard and make it more realistic under actual environmental conditions that may be expected.

Survival in a Helicoptor Survival Suit

No comparable standard exists for helicoptor suits. However, experimental work, measuring the immersed thermal insulating properties of such suits has been performed by a number of groups including Hayward[9] (abandonment and helicoptor suits) and DCIEM[10] (emphasis on helicoptor suits) in Canada. Data from these tests are useful because some of the suits examined are currently used in offshore commuting.

DCIEM found that compression of the suits by hydrostatic pressure considerably reduce their thermal insulating properties

consequently the CLO value provided in documentation was soldom valid during immersion. The bar chart, Table 1.2, shows the results of some of the DCIEM tests including a control (CTRL) which was a man in a summer flying suit. The experiments were carried out at 10°C water temperature.

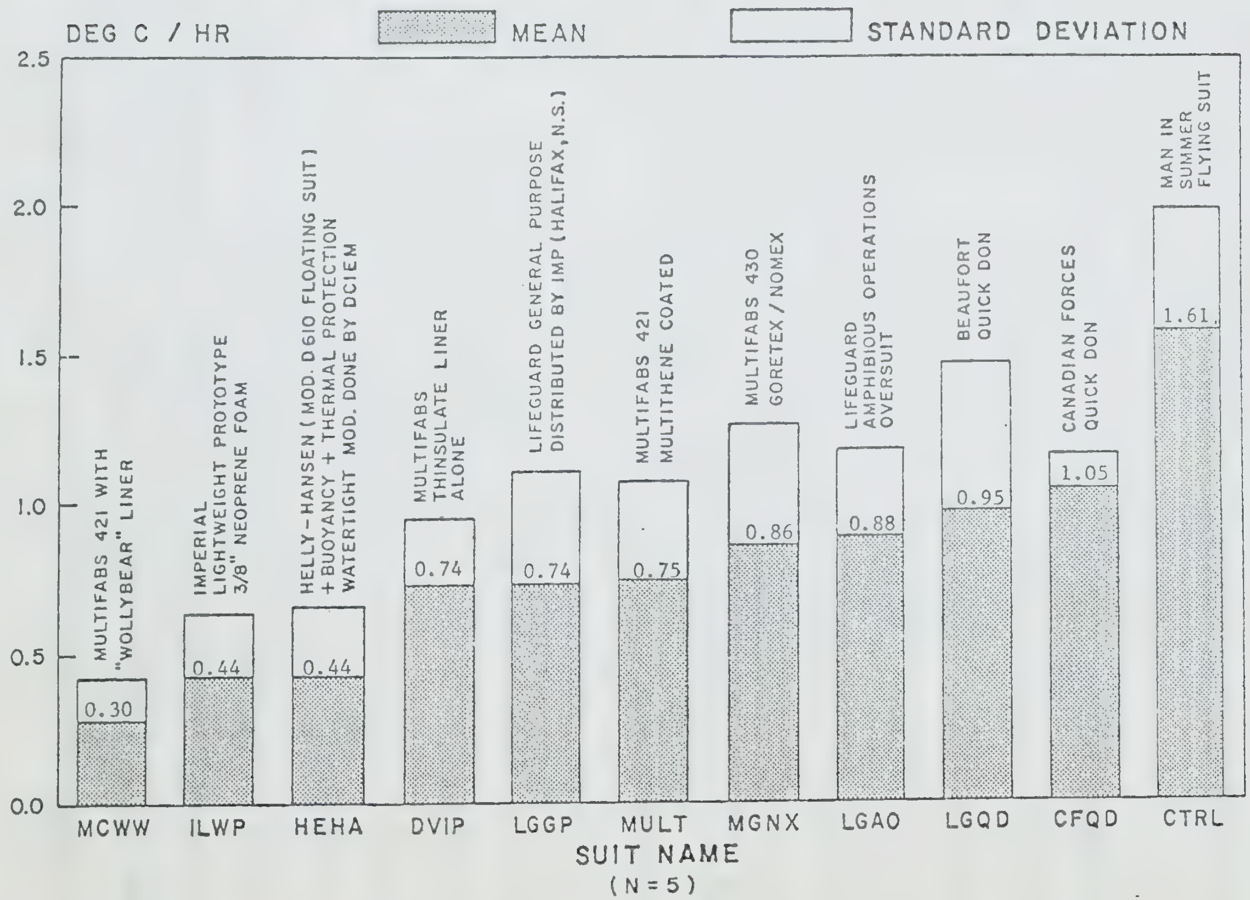
Since these are effectively calorimetry expirments, a projection may be made for cooling rates at other water temperatures by comparing the suits with the control and applying their respective cooling rates to Hayward's hypothermia model using a multiplying factor. The Canadian Survival Model is not valid here as it predicts deaths for reasons other than hypothermia. However, as the DCIEM control was wearing a summer flying suit and life jacket but Hayward subjects were wearing cotton shirt, undershorts, cotton pants, socks, and perhaps a different lifejacket then differences must be taken into account using water at 10° as a benchmark.

Table 1.3 shows the rate of temperature fall at 10°C for Hayward's subjects, for the DCIEM control and for the different suits tested by DCIEM. The column titled IMF (Immersed Multiplying Factor) may be likened to CLO, but is derived from values measured in water.

It is this factor that may be used to multiply the times of Hayward's hypothermia curve to obtain a survival model for man in a helicoptor survival suit in calm water/fair weather (absense of blowing foam).

AVERAGE RATE OF RECTAL TEMPERATURE
FALL FROM PEAK TO END

Table 1.2



Source: DCIEM 1983

TABLE 1.3

COOLING RATE FOR SURVIVAL SUITS

SURVIVOR GARMENT	RATE OF COOLING °C/HOUR (Tcore)	IMF - IMMERSED MULTIPLYING FACTOR (1.85/Tcore)
Hayward's Hypothermia Subjects	1.85	1.0
DCIEM Control	1.61	1.15
CFQD	1.05	1.76
LGQD	0.95	1.93
LGAO	0.88	2.10
MGNX	0.86	2.15
MULT	0.75	2.47
LGGP	0.74	2.50
DVIP	0.74	2.50
HEHA	0.44	4.20
ILWP	0.44	4.20
MCWN	0.30	6.17

The MULTIFAB GNX/430, made of GORETEX with a NOMEX fire retardant surface layer is generally used in commuter helicopters (with either insulating underwear or the MULTIFAB THINSULATE liner). This will clearly be at least as good as the DCIEM model MGNX which reduces the rate of core temperature drop by a factor of $\frac{1.85}{.86}$ or a 2.15 immersed multiplying factor (IMF).

Table 1.4 shows the survival times for persons wearing the MULTIFABS GNX/430 helicoptor suit and the MULTIFABS 421 helicoptor survival suit with the "Wollybear Liner". The MULTIFABS 421 with liner is included as it was the best suit tested by DCIEM.

The survival times were calculated using the Hypothermia Model and the derived Immersed Multiplying Factors based upon the lowest expected temperatures and the highest mean temperatures at each location throughout the year. As such the lowest survival time corresponds to the lowest expected temperature and not the lowest mean temperature experienced at each location throughout the year.

The Table shows that for portions of the year the survival time in all locations is about 1½ hours for a man in a currently used helicoptor immersion suit, and about 4 hours for a man in the MULTIFABS 431 with liner.

TABLE 1.4

SURVIVAL TIMES FOR HELICOPTER IMMERSION SUITS

	Lowest Mean Temp. °C	Lowest Exp. Temp. °C	Highest Mean Temp. °C	Hypothermia Model		MGNX (HELO)		MCWW (HELO)	
				Lowest H_2° Temp.	Highest H_2° Temp.	Lowest H_2° Temp.	Highest H_2° Temp.	Lowest H_2° Temp.	Highest H_2° Temp.
Point A	4.0	.0	13.0	0:42	1:20	1:30	2:52	4:19	8:14
Point B	3.5	-.5	14.0	0:41	1:28	1:28	3:09	4:13	9:03
Hibernia	1.8	-1.8	13.5	0:40	1:24	1:26	3:00	4:07	8:38
Point C	6.0	2.0	19.0	0:44	2:50	1:35	6:05	5:31	17:30
Point D	3.0	-1.0	17.5	0:41	2:10	1:28	4:40	4:13	13:22
Point E	4.0	.0	18.5	0:42	2:35	1:30	5:33	4:19	15:56
Point F	4.0	.0	18.5	0:42	2:35	1:30	5:33	4:19	15:56
Point G	8.0	4.0	21.0	0:48	4:00+	1:43	8:00+	4:56	24:41
Hopedale	-1.8	-1.8	5.0	0:40	0:49	1:26	1:45	4:07	5:02
Baffin	-1.8	-1.8	1.0	0:40	0:43	1:26	1:33	4:07	4:25

1.4 REQUIRED RESCUE CAPABILITIES

1.4.1 Mobile Offshore Drilling Units

The rescue of survivors from a MODU is the most challenging in terms of the numbers of persons to be rescued but MODU's also have better survival equipment than do supply vessels. MODU's present several distinct rescue requirements:

- Planned Evacuation

  Fifty to one hundred persons must be evacuated within a 12 to 18 hour time frame utilizing helicopters or by transfer to a supply vessel.

- Limited Warning Evacuation

  Fifty to one hundred persons must be rescued. The majority of these should be in lifeboats or liferafts, but some personel may be in the water. The rescue of the persons in the water, assuming that they are wearing abandonment suits, must take priority and should take place within less than 6 hours in order to avoid death by hypothermia. The rescue of persons from rafts would then be the second priority with the timing being dependant upon temperature, sea state and other factors. The rescue of persons from lifeboats (TEMPSC) should be the last priority as the chances of survival in an undamaged TEMPSC is very high even under severe environmental conditions.

- Immediate Evacuation

  Fifty to one hundred persons must be rescued. A large number of persons could be in the water and many may not be wearing abandonment suits although it may be possible to launch lifeboats and liferafts.

  The requirements and priorities for rescue are the same as for a limited warning evacuation except that the first priority must be to rescue persons in the water who are not wearing abandonment suits. In the majority of cases this rescue must take place within 15 to 30 minutes.

1.4.2 Supply Vessel

Twelve to sixteen persons must be rescued. The majority of the survivors should be in lifeboats or liferafts but some survivors could be in the water. The survivors should all be wearing survival suits. As with the limited warning evacuation of a MODU the rescue priorities must be:

- persons in the water (approximately 3 hours),
- persons in liferafts, and
- persons in TEMPSC.

1.4.3 Helicoptor

Up to 20 persons must be rescued. The majority of the survivors will be in the water wearing helicoptor immersion suits. During the winter months a rescue must take place within about 1½ hours in all parts of the study area to ensure a reasonable chance of survival.

CHAPTER 2: GOVERNMENT SEARCH AND RESCUE

2.1 INTRODUCTION

The Search and Rescue system in Canada originated fom the Second World War when the RCAF established Rescue Boats at their bases to pick up downed flyers from the sea. After World War II when the use of aircraft for public transportation and general commerce became the norm both nationally and internationally, it was necessary to start a rescue organization on both a national and international scale.

The first recognition of a Search and Rescue (SAR) program occurred in Canada in 1947 when the RCAF was designated the SAR coordinating agency. Cabinet Directive 18 of September 1950 and Cabinet Directive Circular of July 1951 give the Government's first instructions on Search and Rescue and in the same year the SAR organization was broadened to include a SAR function for all Government operated ships.

The present Search and Rescue program consists of several groups. The Department of National Defense operates all aircraft whose primary role is search and rescue while the Department of Transport (Canadian Coast Guard) operates all vessels whose primary role is search and rescue. These primary resources form the nucleus of the Search and Rescue Program.

Other government resources are designated as having a secondary SAR function. These include the warships and some military aircraft of the Department of National Defense, the helicopters and additional vessels of the Canadian Coast Guard, and some vessels of the Department of Fisheries and Oceans.

The Search and Rescue organization in Canada is divided into four Search and Rescue Regions (SRRs) - (Figure 2.1). Each region contains a Rescue Coordination Centre (RCC) which are jointly manned by DND and Coast Guard. RCCs are located in Victoria, Edmonton, Trenton and Halifax. The centres provide the coordination of search and rescue operations using the primary SAR vessels and aircraft in their respective regions and are authorized to call upon secondary and civilian resources if required.

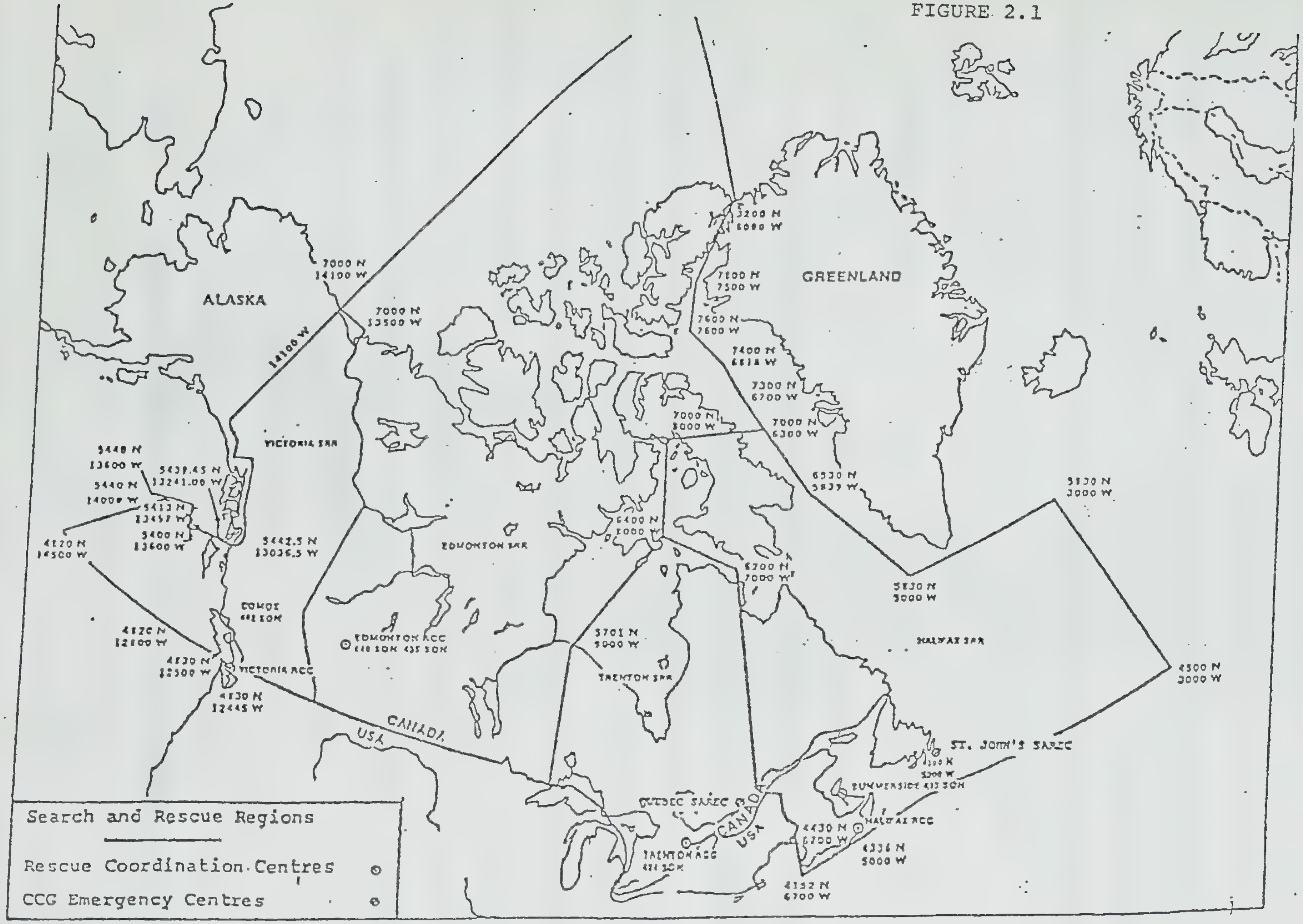
2.2 RESPONSIBILITIES AND OBJECTIVES

2.2.1 International Agreements

Canada is signatory to international agreements which establish responsibilities for search and rescue in coastal waters and on the high seas.

Annex 12 of the International Civil Aviation Organization (ICAO) requires that each state provide such measures of

FIGURE 2.1



Existing Canadian SAR Delimitation and SRR Boundaries

SOURCE: Report on an Evaluation of Search and Rescue

assistance to aircraft in distress in the territories and territorial waters as it may find practical. The obligation is extended to the territories and the territorial waters of neighbouring states by the standards of Annex 12 and to the high seas and areas of undetermined sovereignty by the ICAO Regional Air Navigation agreement. This agreement has given Canada the responsibility to provide assistance to aircraft in distress east to 30°W and west to 145°W.

Responsibilities to provide assistance to vessels in distress are governed by the international laws of the sea and the International Convention for the Safety of Life at Sea (SOLAS). Under the terms of SOLAS each contracting government undertakes to ensure that necessary arrangements are made for coast watch and for the rescue of persons in distress around its coasts. These arrangements should include the establishment, operation and maintenance of such maritime safety facilities as deemed practical and necessary having regard for the density of traffic and the navigational dangers and should, as far as possible, afford adequate means of locating and recovering such persons.

2.2.2 National Objectives and Responsibilities

Objectives

Prior to the completion of the Report on an Evaluation of Search and Rescue[11] in 1982 there were no ministerially approved

objectives for the National Search and Rescue Program. Consequently the report developed objectives for the SAR Program which have been accepted. The objective of the National SAR Program is stated as:

> "To prevent the loss of life and injury through search and rescue alerting, responding and aiding activities which use public and private resources; and by ensuring appropriate priority to aviation and marine safety measures focused on owners and operators most commonly involved in SAR incidents."

In addition to recommending an overall objective for the National SAR Program the Report on an Evaluation of Search and Rescue also determined the implicit objectives that the SAR managers are persuing. These objectives are as follows:

- to know of the existence of all air and marine SAR incidents
- to locate all missing aircraft and vessels and personnel involved in distress incidents
- to save the lives of all survivors of air and marine distress incidents
- to minimize the loss of property pending availability of salvage services, especially for marine distress incidents
- to provide humanitarian assistance and civil aid
- to fulfill international SAR obligations

Responsibilities

The responsibilities of the National Search and Rescue Program as recommended by the Report on an Evaluation of Search and Rescue and accepted by cabinet are stated to be:

> "The Canadian area of responsibility for air and marine search and rescue is as provided for under ICAO agreements, air search and rescue covering Canada and out to 30°West in the Atlantic and 145°West in the Pacific, and under IMCO agreements, marine search and rescue on the Great Lakes, the St. Lawrence River and waters out to 30°West in the Atlantic and 145°West in the Pacific."

Within this area of responsibility the responsibilities of various groups for the provision of services has been defined. Table 2.1 outlines these responsibilities. It should be noted in the table that the Rescue Coordination Centre (RCC) and the Search and Rescue Emergency Centre (SAREC) are in fact staffed by employees of DND and CCG and are responsible for all aspects of Search and Rescue operations when civil vessels or aircraft are involved. Incidents which involve military aircraft or vessels are the total responsibility of the Department of National Defense. Primary responsibility for search and rescue for hikers, land vehicles and small craft in provincial or territorial waters is designated to the appropriate police forces with the Rescue Coordination Centre being responsible only for the coordination of the search by air and for air-ground communications for land search/rescue.

TABLE 2.1

SEARCH AND RESCUE RESPONSIBILITIES

	IN RESPECT OF CIVIL VESSELS IN INTERNATIONAL AND FEDERAL WATERS		IN RESPECT OF CIVIL AIRCRAFT		IN RESPECT OF MILITARY AIRCRAFT OR VESSELS		IN RESPECT OF HIKERS, ETC, LAND VEHICLES AND SMALL CRAFT IN PROVINCIAL OR TERRITORIAL WATERS	
1 FUNCTION OR TASK	2 RESPONSIBLE	3 ASSISTANCE WHERE NECESSARY	4 RESPONSIBLE	5 ASSISTANCE WHERE NECESSARY	6 RESPONSIBLE	7 ASSISTANCE WHERE NECESSARY	8 RESPONSIBLE	9 ASSISTANCE WHERE NECESSARY
OVERALL COORDINATION OF LAND, SEA AND AIR SEARCH a	RCC/SAREC	-	RCC	-	DND	-	POLICE	-
ARRANGEMENT FOR OR PROVISION OF SEARCH AIRCRAFT b	RCC	DND CASARA USCG	RCC	DND CASARA USAF/USCG	DND	RCC USAF USCG CASARA	POLICE	RCC CASARA DND
COORDINATION OF SEARCH BY AIR c	RCC	DND USCG	RCC	DND USAF/USCG CATA/FAA CASARA	DND	RCC CATA/FAA USAF/USCG	RCC	CATA DND POLICE CASARA
PROVISION AND CO-ORDINATION OF SEARCH/RESCUE ON LAND d	RCC/SAREC	POLICE CCG/USCG DND	RCC	DND CASARA USAF POLICE CATA/FAA	DND	RCC USAF CASARA POLICE CATA/FAA	POLICE	DND CASARA
AIR-GROUND COMMUNICATIONS FOR LAND SEARCH/RESCUE e	RCC	CCG DND POLICE USCG	RCC	DND CATA/FAA USAF	DND	RCC USAF CATA/FAA	RCC	CATA DND POLICE CASARA
ARRANGEMENT FOR OR PROVISION OF SEA SEARCH f	RCC/SAREC	CCG/DFO DND CMRA	RCC/SAREC	DND CCG/DFO USCG CATA/FAA	DND	RCC USCG USAF CCG/DFO	POLICE	RCC/SAREC CMRA CCG
COORDINATION OF SEARCH BY SEA g	RCC/SAREC	DND CCG/DFO USCG	RCC/SAREC	DND CCG/DFO USCG CATA/FAA	DND	RCC/SAREC USCG CCG/DFO CATA/FAA	POLICE	RCC/SAREC CCG DND CMRA
COMMUNICATIONS (OTHER THAN AIR/SURFACE) h	RCC/SAREC	CCG/DFO DND USCG	RCC	DND CCG CATA/FAA USCG	DND	RCC USAF/USCG CATA/CCG/FAA	POLICE	RCC CATA/CCG DND
AIRCRAFT/SHIP RELAY COMMUNICATIONS WHERE DIRECT COMMUNICATIONS NOT AVAILABLE i	RCC	CCG/DFO DND USCG CMRA CATA/FAA	RCC	DND CCG USCG DFO CMRA CATA/FAA	DND	RCC USCG CCG/DFO CATA/FAA	POLICE	RCC CCG DND CATA CASARA

SOURCE: Report on an Evaluation of Search and Rescue

2.2.3 Departmental Objectives

In addition to the National SAR objectives the Department of National Defence, Transport, and Fisheries and Oceans each have their own departmental objectives which were developed by an interdepartmental working group and presented to ICSAR in February 1979.

Department of National Defence Objectives

The group proposed the following objectives for the Department of National Defence:

- To coordinate, control and conduct SAR operations for aircraft in distress in the Canadian area of responsibility;
- To coordinate and, in collaboration with the Canadian Coast Guard, control and conduct SAR operations for ships in distress within the Canadian assigned area of responsibility;
- To conduct mercy flights and other humanitarian tasks;
- To conduct ground searches;
- To maintain an appropriate SAR response capability;
- To maintain operational liaison with DOT/AIR, DOT/CCG and other appropriate authorities through such procedures as search master reports to promote the highest level of safety in the civil aeronautic and marine environments;
- To support DOT/AIR and DOT/CCG in SAR prevention through participation in education programs.

These objectives have been adopted by DND in 1984 and included in the Defence Services Program.

DOT Air Administration (CATA) Objectives

The group proposed the following objectives for the DOT Air Administration:

- To assure that for civil aircraft in distress in Canada as in the various areas of responsibility the means and methods are provided to achieve efficiency in alerting the responsible SAR agency, in locating the distress incident and in succouring and rescuing survivors;
- To provide the DND SAR organization with specialized departmental resources and expertise as a functional part of the organization;
- In cooperation with DND and in consideration of recommendations from that department to develop and implement SAR prevention programs designed to promote a high level of safety in civil aeronautics.

The Deputy Air Administrator has agreed to these objectives but they have not been approved by the minister.

DOT Marine Administration Objectives

The group proposed the following objectives for the DOT Marine Administration:

- In cooperation with and subject to coordination by DND to control and conduct SAR operations for ships in distress within the Canadian assigned area of responsibility;
- To maintain a sufficient level of SAR response capability to ensure a reasonable probability of locating and rescuing persons in marine situations where lives are at risk, or where deteriorating circumstances are such that if prompt action is not taken, risk of life is imminent;
- In responding to marine distress situations reasonable efforts may be made to minimize loss of property, providing the availability of salvage, at no time must action be taken which would interfere with action to preserve life and minimize personal injury or which could endanger the rescue craft or her crew.
- In cooperation with governmental and private groups that have marine safety interests or responsibilities, to promote the highest practicable level of marine safety in order to minimize demands for SAR operations.

These objectives have the agreement of departmental mangement but have not been approved by the minister.

DFO SAR Objectives

The group proposed the following objectives for the Department of Fisheries and Oceans:

- To assist agencies with primary SAR responsibility through the provision of multi-tasked SAR resources, to the extent practical;
- To maintain awareness of safety implications in all aspects of the planning management and execution of departmental programs.

2.3 SAR MANAGEMENT

2.3.1 Organization

National

The responsibility for the Administration of the National Search and Rescue program rests with a designated lead minister. The lead minister is currently the minister of National Defense as the minister accountable to the Cabinet Committee of Foreign and Defence Policy for SAR within the Policy and Ependiture Management System. A clearly defined line of responsibility for policy making, planning, programming monitoring and review of SAR runs from the lead minister to the Chairman of the Interdepartmental Committee on Search and Rescue (ICSAR). ICSAR is comprised of members from the Department of National Defense, Department of Transport (Canadian Coast Guard and Canadian Air Transport Administration), Department of Fisheries and Oceans, Royal Canadian Mounted Police, Atmospheric Environmental Service and Department of Energy Mines and Resources and others as may be designated from time to time.

The Chairman of ICSAR is currently the Chief of Air Doctrine and Operations in the Department of National Defense and the Vice Chairman is the Commissioner of the Canadian Coast Guard.

The responsibilities of ICSAR[12] have been ratified by Cabinet as they were set out by the Report on an Evaluation of Seach and Rescue. These responsibilities include:

- Coordinating the development of improved management and financial control and reporting systems, and the operations research, costing models and data bases to support them;
- Structuring the long term national SAR Program Plan;
- Developing policies to achieve the best balance between the use of primary and secondary SAR resources in non-distress incidents;
- Reviewing and developing the coordination of SAR related research and development;
- Coordinating the publication of an annual review of SAR incident characteristics;
- Coordinating SAR public information programs regarding the delivery of SAR services;
- Developing and maintaining a National SAR Manual;
- Coordinating and developing SAR operations and prevention policies.

The major role of ICSAR is to provide a focus so that departments involved in SAR operations can consolidate their planning and to provide overall direction for the SAR program.

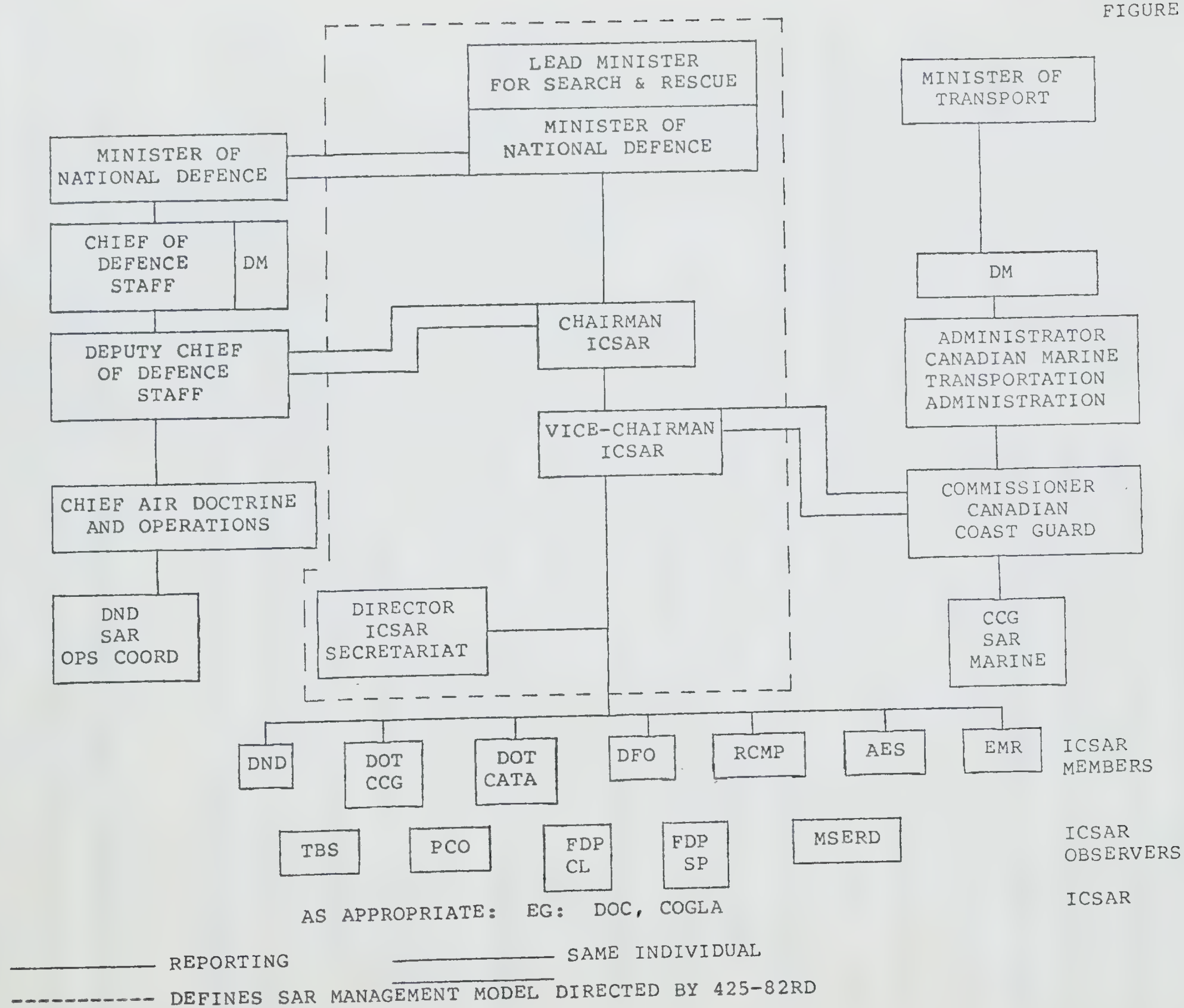
ICSAR is supported by a Secretariat in its management of the federal SAR program. The Cabinet Decision outlines the mandate[12] of the Secretariat to consist of: "coordinating and integrating SAR program structure development, the planning process, and the policy development process; assessing departmental input to the

foregoing; advising ICSAR on interdepartmental program issues; coordinating and/or carrying out staff duties at the direction of ICSAR; providing a single source of information on the SAR program; developing and maintaining SAR program information systems; and providing ICSAR with staff support for its meetings." The ICSAR Secretariat therefore fulfills the staff role in carrying out the responsibilities of ICSAR.

The essence of the management process (figure 2.2) provides for the line departments to propose to ICSAR what is required in their individual department. ICSAR with the aid of the ICSAR Secretariat would then consolidate the proposals from the various line departments into a combined proposal for the SAR program. ICSAR, with the advise of the Secretariat, would alter individual department proposals to ensure that they are in keeping with the overal SAR objectives. When a proposal for the overall SAR Program has been approved by ICSAR it is presented to the Lead Minister who then would recommend its implementation to the Foreign and Defence Policy Committee. The final decision for SAR proposals therefore lies with the Cabinet Policy Committee.

When a proposal has been approved, the mangement system provides for the line of responsibility to run back through the Lead Minister to ICSAR and finally to the line departments who would execute the Search and Rescue program in accordance with the approved plan.

FIGURE 2.2



SOURCE: ICSAR Secretariat

SAR Management Structure

Regional

Coordination of SAR operations within each of the Search and Rescue Regions is carried out from Rescue Coordination Centers (RCC's). RCC's are presently co-located on military bases at: Halifax, Nova Scotia; Trenton, Ontario; Edmonton, Alberta; and Victoria, British Columbia. In addition, the Halifax and Trenton regions each have one Search and Rescue Emergency Center (SAREC) located in St. John's, Newfoundland and Quebec, Quebec respectively.

Each Search and Rescue region has an overall commander appointed by the Department of National Defence. The Search and Rescue Region Commander is responsible for the operation of the RCC and of all SAR resources within the region. The commander is assisted by Staff Officers and maintains a liason with the Regional Directors of the Coast Guard.

RCC's operate under the supervision of a Commanding Officer appointed by the Department of National Defence who reports to the Region Commander. RCC's are manned on a continuous basis by a staff of 3 persons but each duty watch has four full time positions; shift supervisor, marine controller, air controller and assistant controller.

Marine controllers are Coast Guard personnel while air controllers are Department of National Defence personnel. Either

the air controller or the marine controller doubles as the shift supervisor on each duty watch.

The shift supervisor, whether he be the air controller or the marine controller, is responsible for controlling and coordinating the response to SAR incidents. This responsibility includes monitoring the SAR activities of SAREC's within the region, ensuring that appropriate action is initiated for reported incidents, appointing Searchmasters and on-scene commanders for specific incidents, coordinating search efforts and tasking of primary, secondary and non-SAR resources.

Marine and air controllers work under the direction of the shift supervisor and are responsible for monitoring communications systems within the RCC and ensuring the receipt of all incoming SAR calls.

Marine controllers are primarily responsible for the coordination and control of the response to marine incidents while air controllers are primarily responsible for air incidents. However, a great deal of overlapping responsibility occurs here as air controllers are generally responsible for tasking coordinating and controlling SAR aircraft whether for an air or for a marine incident.

2.3.2 Funding

Funding for SAR equipment operations and training is currently provided entirely by the federal government. There are no sources of additional income to the system through a "user pay" or other cost recovery technique.

The budget for the SAR program, is currently divided into two parts as are all department budgets, an "A Base" budget and a "B Base" budget.

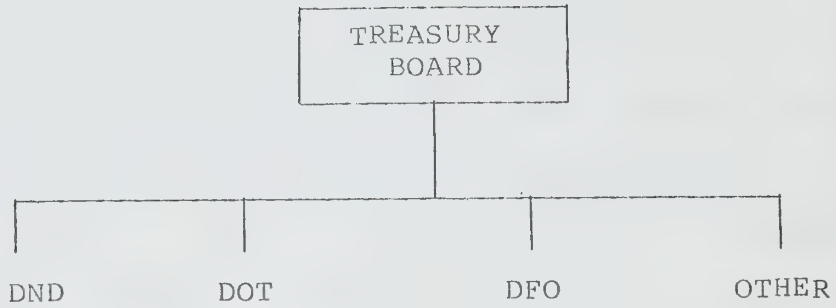
The "A Base" budget includes the funds required to maintain the existing levels of SAR service and includes such items as salaries and maintenance as well as capital funds for the replacment of existing resources. The "A Base" Budget for SAR is contained in the overall "A Base" Budget of each line department. As such the "A Base" Budget portion of the SAR program is approved by Treasury Board when the overall "A Base" Budget for each department is approved. No separate approval of the SAR Portion in each department's budget is required. ICSAR has no input into the formulation or coordination of the SAR "A Base" Budget (Figure 2.3).

The "B Base" budget includes funds for the improvement of the SAR program. This includes the funding of the ICSAR Secretariat, the purchase of additional resources and the funding for new SAR programs. The "B Base" budgets for the SAR program

FIGURE 2.3

SAR FUNDING PROCESS - CURRENT

"A BASE" BUDGET



are prepared by each of the line departments and submitted to ICSAR. Under the present management system, ICSAR is then required to consolidate these Budgets into an overall "B Base" Budget for the SAR program.

This Budget is then submitted to the Foreign and Defense Policy Committee where it is included as an expenditure item in the Defence Envelope. The Foreign and Defense Policy Committee may make adjustments to this budget in order to consolidate this budget with others which have been proposed in the Defense envelope. The Foreign and Defense Policy Committee then forwards the Defense Envelope budget, along with others for which it has responsibility, to the Planning and Priorities Committee.

Since the Planning and Priorities Committee approves only the overall budget of the Foreign and Defense Policy Committee, changes may have been made to the SAR portion of this budget from what was originally proposed by ICSAR. The management system is designed such that this revised SAR budget will then flow downwards to ICSAR. ICSAR would then allocate the funds to the line departments (Figure 2.4).

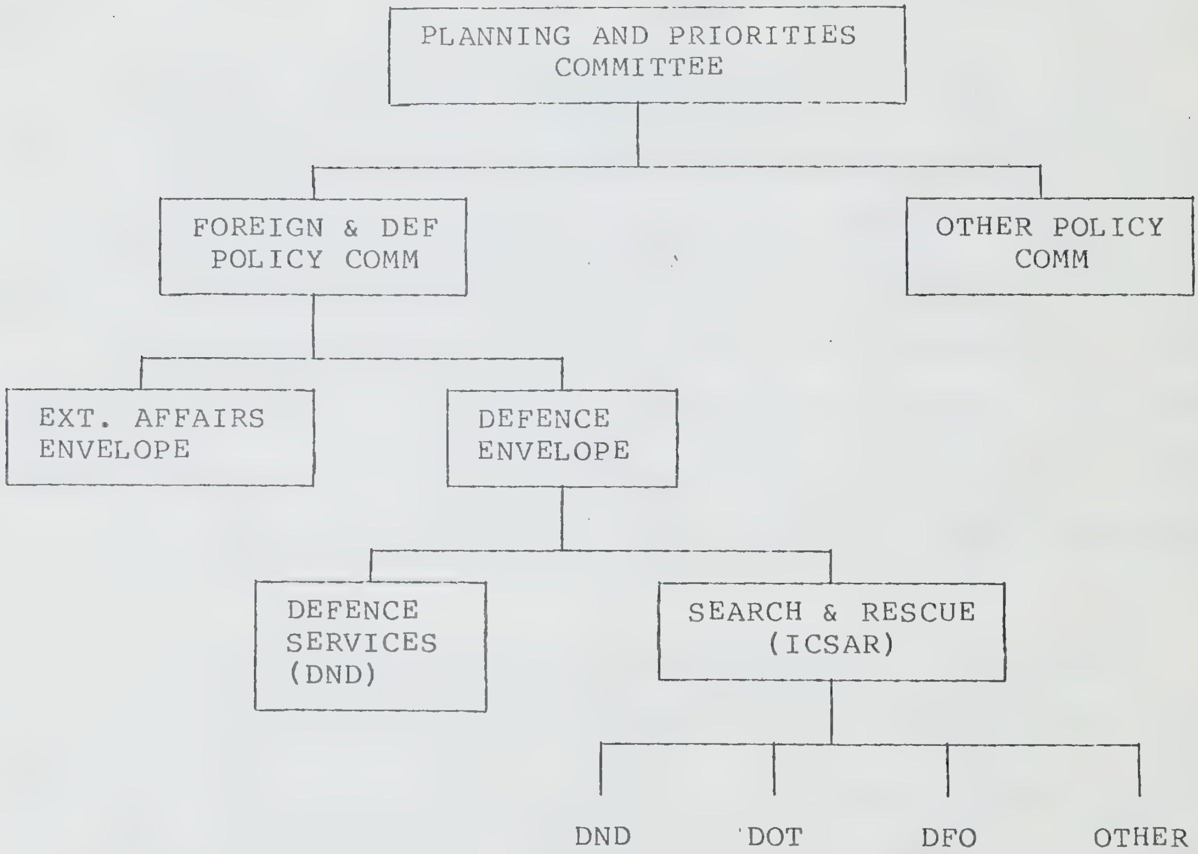
2.3.3 Proposed Changes

No changes are planned in the overall management structure in the near future but a strengthening of the ICSAR Secretariat from four persons is proposed. Increasing the resources in this

FIGURE 2.4

SAR FUNDING PROCESS - CURRENT

"B BASE" BUDGET



group would allow more in-depth analyses of program needs, and line department funding proposals and increased support to ICSAR.

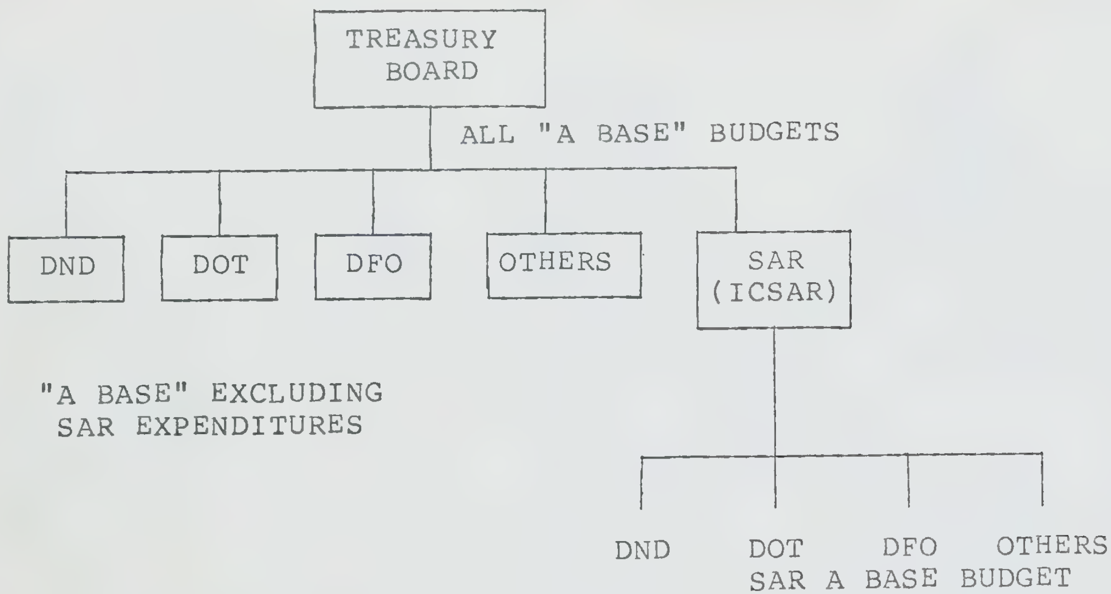
The second proposed change is in the area of funding. The Report on an Evaluation of Search and Rescue recommended that the federal SAR program be financed from one expenditure envelope and the government has agreed to implement this recommendation.

Financing of the SAR program through a single envelope would require that both the "A and B Base" budgets from each line department be submitted to ICSAR for approval. ICSAR would then present the SAR "A Base" budget to Treasury Board for approval rather than having each line department present its portion as part of their overall "A Base" budget.

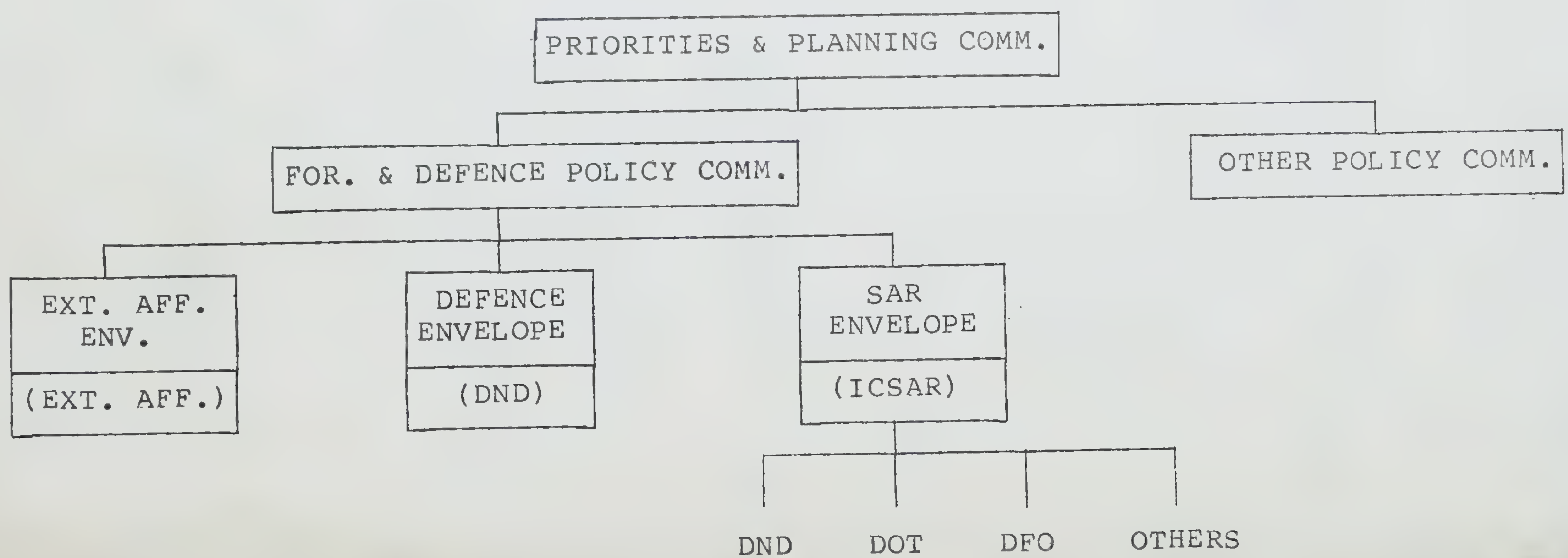
Under this plan the SAR "B Base" budget would be presented directly from ICSAR to the Foreign and Defense Policy Committee as a separate SAR envelope, and would no longer be included in the defense envelope (Figure 2.5).

FIGURE 2.5

SAR FUNDING PROCESS - PROPOSED
"A BASE" BUDGET



"B BASE" BUDGET



2.4 SAR EQUIPMENT AND PROCEDURES

2.4.1 Air Resources (Primary and Secondary)

In the Halifax SAR region, the primary resources are based at Summerside, PEI (3 Buffalo and 3 SARCUP helicopters) and Gander (3 SARCUP helicopters). The most commonly tasked secondary resources are the CP 140 Aurora maritime patrol aircraft based at Greenwood, NS; the CH 124A Sea King anti-submarine warefare helicopter, based in Shearwater, NS; and HMC ships when available.

Other aircraft which have potential for offshore rescue are the helicopters used for personnel transport to the rigs, particularly the S-61 and Super Puma, based at Halifax International Airport, NS and St. John's Torbay, NF.

Operational Limits

The CH113 SARCUP and CH124A Sea King helicopters are medium lift helicopters built in the early 1960's. The SARCUP helicopters are a recently upgraded version of the Boeing Vertol CH113/ CH113A Labrador/Voyageur.

Two slightly different versions of the SARCUP helicopter exist but the difference is only in the range of the helicopter. The SARCUP helicopters which are upgraded versions of the CH113 Labrador have smaller fuel tanks than the helicopters which were

upgraded from the CH113A Voyageur. Consequently the upgraded Voyageurs have a slightly longer range and endurance. Since these helicopters are frequently transferred from location to location the capabilities of the shorter range upgraded Labrador will be used for all SARCUP helicopters.

The SARCUP is a twin turbine, tandem rotar amphibious helicopter with a normal speed of 115 kts and a radius of action of 225 nm based upon normal IFR flight planning criteria, and a 30 minute loiter time at maximum range.

This 225 nm radius does not represent the aircraft endurance to zero fuel but does represent the maximum practical radius of action under the majority of conditions.

The SARCUP helicopter is limited for rotor startup to winds of 52 kts. This limitation is not a factor in Summerside where the helicopters can be started in a hanger, but is significant in Gander where no hanger is available.

The helicopters are authorized by DND to take off and land from Summerside and Gander with a 200 ft. ceiling and 1/4 mile visibility and can land on rigs with a 200 ft. ceiling and 1/2 mile visibility. Factors for landing on a rig such as heave, pitch and roll are at the aircraft commanders discretion.

The SARCUP helicopters carry a full range of communications equipment which permit communications with marine craft, other aircraft and with shore bases. This communications equipment is also used as a direction finding/homing system which can home in on marine and air distress beacons. Navigation equipment includes both area navigation and point navigation and landing approach aids.

The SARCUP has a permanently fitted continuous duty hoist as well as an external hook for slinging loads such as EMPRA baskets or rescue nets.

The CH124A Sea King helicopter is a military version of the Sikorski S61. The Sea Kings stationed at Shearwater have slightly less range than the SARCUP (170 nm for flight planning purposes) but have the same cruising speed (115 kts). Wind limit for rotor start up is 60 kts and the helicopters are authorized for take-off and landing at Shearwater with a 100 ft ceiling and 1/4 mile visibility. Landing limits for rigs are the same as for SARCUP helicopters.

Communications and navigation equipment are much the same as for the SARCUP but the Sea Kings have an automatic flight control system and doppler radar which gives them an autohover capability. As with the SARCUP the Sea Kings have external cargo hooks and continous duty hoists.

The CC115 Buffalo is a twin-engine turbo prop aircraft with a normal speed of 210 kts and a radius of action of approximately 500 nm with a one hour loiter time at maximum range. This range is based upon normal IFR flight planning criteria.

The Buffalo is equipped with a full range of communications and navigation equipment. Although used primarily for searches, the Buffalo carries droppable survival equipment, droppable pumps, flares and markers.

The CP140 Aurora, a secondary SAR aircraft, functions in the same search role as the Buffalo. The Aurora has a much higher speed, 360 kts, and a radius of action of 1000 nm with 4 hours loiter at maximum range. The Aurora has forward looking infra-red radar which greatly enhances its search capability over that of the Buffalo. The Aurora, like the Buffalo, carries droppable survival equipment, droppable pumps, flares and sonobouy markers.

RESPONSE TIMES

Aircraft Serviceability/Availability

The current requirement for Search and Rescue aircraft across Canada is:

a. 30 minute standby: five days per week, eight hours per day;

b. 2 hour standby: all other times.

These times may be varied to suit local conditions and seasonal adjustments depending on predicted requirements.

DND has provided a breakdown for the period June 1982 to May 1983 of the ability of their SAR standby aircraft to meet the response requirements of 30 min. during working hours (normally 0800 to 1630 Monday to Friday) and 2 hours at other times.

This standby commitment requires the availability of one fixed wing and one rotary wing SAR aircraft (rotary wing only at Gander) at all times on 30 min./2h readiness.

Based upon flying rates, serviceability rates, availability of spares and unit maintenance capabilities, DND has found it necessary to have a unit establishment (UE) of three aircraft of each type.

If more than one aircraft is required on a regular basis, this UE has to be raised. If the operational requirement for

aircraft is low and the reduced probability of having one aircraft available can be tolerated, the UE might be reduced.

Of a total of 653 scrambles to SAR in 1982/83, there were 66 or 10.1% delays. These delays are categorized under five headings; they are:

a. Technical - a fault in the standby aircraft which renders it unserviceable or unsuitable for the proposed mission. A repair or a change in aircraft may be necessary. Such faults would only become known when the aircraft is preparing to depart, that is, an aircraft known to be unserviceable would not be put on standby.

b. Weather - weather at the SAR unit or on the immediate route to the incident precludes take-off.

c. Personnel - sufficient personnel are not available to effect the departure. An example would be vital crew members delayed by unexpected weather, or sudden injury or illness during the departure sequence.

d. RCC Directed - a delay due to a stipulation by the RCC for a specific take-off time. Some examples would be: to coordinate a fixed wing/rotary wing or rotary wing/vessel response, because of unsuitable weather in the search area, or to permit RCC to gather further information.

e. Other - an unusual circumstance which does not fit the other categories. It is seldom used and could include a delay such as might be caused by Air Traffic Control congestion.

Table 2.2 displays the number and type of delays at each unit for each type of aircraft. The number of RCC directed delays on the coasts reflects the high incidents of poor offshore weather and the number of coordinated responses encountered in these areas.

Prior to the upgrading of the Labrador/Voyageur helicopters to SARCUP, Canadian Forces SAR helicopters could not operate more than 50 nm offshore without fixed wing air support. Departmental guidance still requires that whenever possible a fixed wing aircraft fly top cover if the helicopter operates more than 50 nm offshore. This is intended to provide improved communication and navigation, act as an on-scene commander and provide assistance in emergency (helicopter engine or transmission failure). However, although a Rescue Coordination Centre will provide fixed wing cover as soon as possible, the first priority is to task and scramble the SAR helicopter and no delay in the helicopter response results. It will take off and transit to the scene of the SAR incident as soon as possible.

The rescue time of SAR helicopters is measured from the time the unit is tasked with a mission by the RCC. It includes the standby posture (30 min. during working hours and 2 hours at other times) and transit time. Search time is considered minimal in the offshore context.

RESOURCE DELAY BY
SQN/TYPE & CAUSE
JUNE 82 - MAY 83
ALL AIR & MARINE CASES

	103 RU Gander		413 Sqn Summerside		424 Sqn Trenton		440 Sqn Edmonton	435 Sqn Edmonton	442 Sqn Comox			
A/C TYPE	Lab	Voy	Voy	Buf	Buf	T Huey	T Otter	Herc	Lab	Voy	Buff	TOTAL
- Technical	0	1	1	1	3	1	0	0	1	0	0	8
- Weather	0	2	3	2	0	2	1	0	3	0	1	14
- Personnel	0	0	0	1	0	0	0	0	1	0	2	4
- RCC directed	2	3	7	15	1	1	1	2	4	0	2	38
- Other	0	0	0	0	1	0	0	0	0	1	0	2
TOTAL	2	6	11	19	5	4	2	2	9	1	5	66

Note: RCC directed delays may be caused by many factors; three of the main ones are:

a. search area weather
b. coordination of multi-unit operations
c. awaiting further information in the RCC

Still air transit times for SARCUP helicopters were developed for several locations along the Grand Banks and Scotian Shelf. These transit times assume an average speed of 115kts and an endurance of 4 hours, 30 min. which allows a 45 minutes fuel reserve. It has also been assumed that there will be a rig at Hibernia at all times and that it could be used for refuelling and staging survivors.

Rescues at locations on the Grand Banks and Scotian Shelf are limited by two factors; flight planning requirements and the maximum range of rescue aircraft.

The fuel requirements for flight planning are as follows:

Visual Flight Rules (VFR). Helicopter - to destination plus 20 minutes at normal cruise speed.

Instrument Flight Rules (IFR). Helicopter - to destination plus alternate airport plus 45 minutes at normal cruise speed.

Weather at St. John's dictates that the majority of flights to the rigs (estimated in the order of 70%) must be made on an IFR flight plan; in addition, because poor weather is frequently the cause of a SAR incident, rescue missions are usually performed in conditions requiring an IFR flight plan.

For an incident beyond Hibernia, a SARCUP helicopter out of Gander could land and refuel at a rig at Hibernia. It would then

depart on the rescue mission from Hibernia using the same rig as its destination and St. John's as its alternate. Under IFR flight rules the SARCUP would therefore be limited to a radius of approximately 170 nm from the rig. If 30 minutes were required for the rescue then this radius is reduced to about 140 nm.

A similar situation exists for SARCUP helicopters, out of Summerside and refuelling at Sable Island.

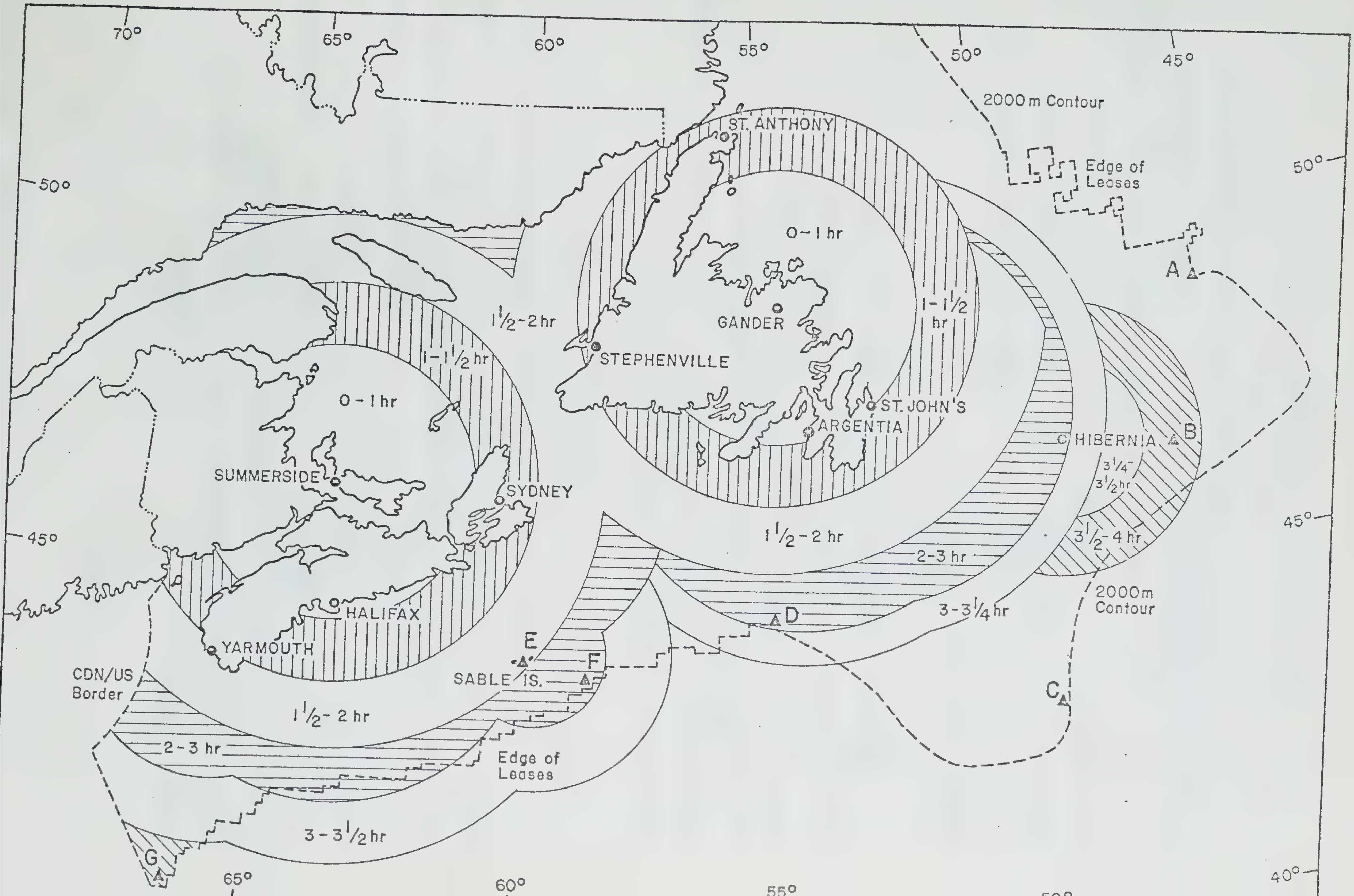
Figure 2.6 outlines the transit times for SARCUP helicopters out of Gander and Summerside. The outermost times do not represent the maximum range of the SARCUP helicopters assumming a 30 minute rescue time and IFR flight rules as these helicopters can travel slightly further than is shown.

The times represent only the transit time of the helicopter. During daylight hours an additional 30 minutes would be required before the helicopter would arrive at the location and at night an additional 2 hours would be required.

The figure illustrates that SARCUP helicopters out of Summerside can reach all of the Scotian Shelf and that during daylight hours most of the locations could be reached in less than 3½ hours. The southern and northern portions of the Scotian Shelf however would take up to 4½ hours to reach.

TRANSIT TIME - SARCUP

Figure 2.6



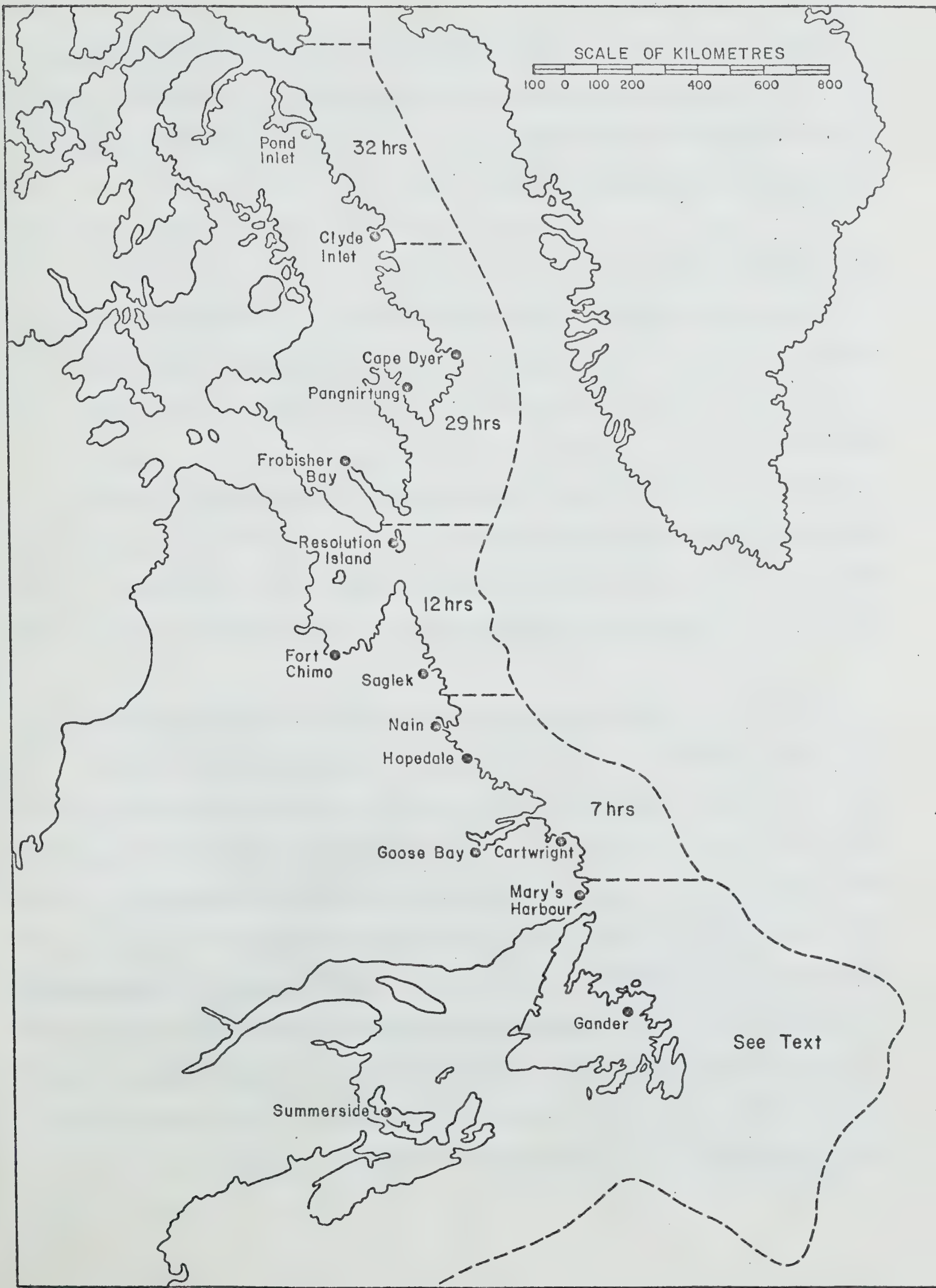
The southern and northeastern Grand Banks are beyond the range of the SARCUP helicopters based in Gander. At the present there is no drilling being conducted in these areas and there are only a few leases on the southern Grand Banks. The SARCUP helicopters can reach Hibernia and northern areas in about 3½ hours during daylight hours but require 4½ hours to reach the Flemish Pass area.

The map at Figure 2.7 shows rescue time in pictorial form for the coasts of Labrador and Baffin Island. Following a scramble from 2 hours readiness, these times assume a routing from Gander through Goose Bay, Fort Chimo, Frobisher Bay, Clyde Inlet to Pond Inlet and the Canadian Forces criteria of a 15-hour crew day and mandatory crew rest of 10 hours.

The Rescue times developed are approximate, since they assume take-off from en route bases for the rescue mission. In practice, they would be marginally shorter; for example, if there were an incident off northern Labrador, routing would probably not be Gander - Goose Bay - Chimo - rescue site; since fuel would be available at the oil company base of operations, it would more likely be Gander - Goose Bay - Saglek - rescue site. However, times shown indicate a reasonable estimate of still air deployment times assuming no delays for weather or aircraft unserviceability.

Figure 2.7

SARCUP HELICOPTER - RESCUE TIME



The rescue times developed for the Labrador coast indicate that SARCUP helicopters will take a minimum of 7 hours to reach an incident on the southern coast of Labrador and in excess of a day to reach the Davis Staits.

Rescue Procedures

The SAR system has four techniques at its disposal to rescue or assist persons in distress. They are; dropping a survival package from fixed wing aircraft or a helicopter, landing the helicopter on the water or on deck and assisting survivors to board the aircraft, recovering survivors by net from a deck or water using a 2-man Billy Pugh net on the hoist, and winching survivors into the helicopter using a hoist with a person decending to assist the survivor.

The CC115 Buffalo aircraft carry the MA-1 survival kit which can be dropped out of the aircraft to assist persons in the water. The MA-1 consists of two inflatable liferafts joined by a line and equipped with some survival stores. The MA-1 is deployed when other rescue means are not immediately available and survivors must be able to help themselves into the liferafts and remain alive until they can be rescued. The MA-1 only brings the survivors into a less hostile environment than the sea and does not ensure their survival. However as a short term tool its use is important as it gives survivors a place of refuge until they can be rescued by a helicopter or a surface vessel.

Landing a helicopter on the water or on deck is the quickest and most effective way to rescue a group since it brings survivors immediately to safety. The feasibility of a deck landing will depend upon the degree of list and motion. Even with significant list, a helicopter may be loaded through the passenger door providing it can perform a two-wheel touchdown. The decision to attempt a deck landing is left to the aircraft commander's discretion and will depend upon the circumstances which prevail.

Amphibious landings are restricted to calm (under 3' waves) conditions. If rescue can be assured by other means, helicopter crews will probably use them because amphibious landings in salt water result in excessive maintenance of the aircraft.

SARCUP helicopters have the capability to recover survivors using a Billy Pugh net on the hoist. The Billy Pugh net used by SAR has a two man capacity which is compatable with the 600 lb capacity of the hoist. The net has a rigid base frame with netting to support the casualty. Further netting encompasses three sides of the base where a bouyant ring is attached. A C-shaped support with bouyancy is fixed to the netting near the top. The net can be stored inside the helicopter while in transit and can be used to recover survivors from a deck when landing is not possible, or from the water.

The use of the Billy Pugh net as a rescue tool enables survivors to be hoisted in the net and transferred directly into the helicopter. As the net can be stowed inside the helicopter it does not affect its transit speed.

While the Billy Pugh net can be effective in hoisting survivors from a deck its use for recovering persons from the water is extremely limited. Survivors in the water must be capable of helping themselves into the net which can only be entered from one entry point. The survivor must be capable of holding on to the sides of the net while hoisting to prevent the possibility of falling out.

A rescue of 18 persons, the capacity of a SARCUP helicopter, using a Billy Pugh net on the hoist, would take about 1 hour. This technique is not frequently used by SAR as single man hoisting is preferred.

The SAR system currently does not use the EMPRA basket as a rescue tool but are in the process of evaluating its use. The SARCUP helicopters have the capability to use the EMPRA basket in the same manner as the industry helicopters. The use of the EMPRA basket by industry helicopters is discussed in Section 3.4.

The preferred rescue technique for SAR helicopters is the use of the single man hoist. The helicopters have a permanently fitted continuous duty hoist and a trained SAR technician

(SARTECH) who decends down the hoist to assist survivors into a horsecollar.

It is essential that a SARTECH be available to help the survivor into the horsecollar as personnel must be trained in how to properly fit this equipment. If not properly fit there is a high risk that the survivor could drop out of the horsecollar while being hoisted. If the survivor is wearing a survival suit the horsecollar is almost impossible to fit without assistance.

This technique enables the survivor to be transferred from the hoist directly into the helicopter and because a SARTECH is available to fit the horsecollar, survivors do not have to be capable of self-help. This technique can be used to rescue persons from a deck, if landing is not possible, or from the water, even under quite severe conditions although the lack of auto-hover on SARCUP helicopters reduces the capability to effect this type of rescue at night and in poor weather. The rescue of 18 persons (SARCUP capacity) would take from 45 minutes to 1½ hours depending upon the environmental conditions.

2.4.2 Marine Resources

The Canadian Coast Guard operates a number of small rescue boats which are based at various points along the coasts of Canada. These boats are limited in their range and are typically

only used for rescues quite close to shore. These vessels are unlikely to be used in an oil industry related emergency and therefore will not be discussed in this study.

The primary marine SAR resources which may be available to assist in an oil industry incident off the East Coast of Canada are the four large primary SAR vessels of the Canadian Coast Guard. Two of these vessels, the Grenfell and the Jackman, patrol the coasts of Newfoundland while the other two, the Alert and the Daring, patrol off Nova Scotia. The Daring is scheduled to be replaced by a new vessel currently under construction.

These vessels typically patrol quite close to shore and it is unlikely that they would be in the vicinity of an incident involving a MODU; however, they could be called upon to assist in the rescue of persons from lifeboats or liferafts following the evacuation of a MODU or to rescue persons from helicopters or supply vessels if an incident occurred near their location.

CCGS Grenfell and Jackman

Grenfell and Jackman are sister ships which are identical in most respects. These vessels were origionally offshore supply vessels which were acquired by the Coast Guard in the 1970's and outfitted for Search and Rescue duties.

Both vessels are 56 meters in length and are powered by four main engines which develop 6560 hp. Propulsion is provided by twin fixed pitch screws and the vessels are fitted with a 360 hp bow thruster. The vessels have bridge control of the propulsion machinery but do not have joystick control.

Both vessels are ice strengthened and are equipped with a towing winch and towing hawsers.

The rescue zone on these vessels is located aft of the accomodations as it is on most supply vessels. This area is clear of propellors and thrusters and has a freeboard of .86m. There are quite high bulwarks in this area which would add considerably to the height which a survivor would have to climb.

The vessels are equipped with a helicopter winching area on the open aft deck.

The rescue equipment on these vessels includes:

- First Aid equipment
- Pyrotechnics
- Stretcher
- Diving equipment
- Line throwing apparatus
- Scramble nets

Jackman carries 5 inflatable liferafts with a total capacity of 61 persons while Grenfell carries four with a total capacity of 67 persons.

Both vessels are outfitted with a three tonne crane which is used to launch and recover the rescue boats. The rescue boats are a Boston Whaler and a rigid bottom inflatable boat both of which are powered by outboard motors.

The vessels are equipped with searchlights and a full range of communications equipment. Immersion suits are carried for the crew complement plus 30%.

The vessels do not have a sick bay/hospital. Vacant cabins are used to give aid to survivors and equipment is available for the treatment of a limited number of hypothermia victims. The standard medical supplies required by all vessels of this class are carried as well as a portable recessitation kit.

Jackman and Grenfell are equipped with firefighting equipment and carry portable pumps.

CCGS Alert

Alert is the only vessel of the four which was designed and built for the Coast Guard.

The vessel is 71 meters in length and is powered by four main engines which develop 10,560 hp. Propulsion is provided by twin controllable pitch propellors and the vessel is fitted with a 200 hp bow thruster. The vessel has bridge control of the propulsion machinery but does not have joystick control.

The rescue zone on the Alert is located near midship and thus is clear of the propellors and thruster. The vessel has a freeboard of 1.3 meters but there are bulwarks in this area, the height of which are not known.

The vessel is equipped for towing and has a deck and hanger for a light helicopter.

Rescue equipment on the Alert includes:

. First Aid equipment
. Pyrotechnics
. Stretcher
. Diving equipment
. Line throwing apparatus
. Scramble nets

Alert carries four inflatable liferafts and two inflatable Zodiac boats which are used as rescue boats. The Zodiacs are eqipped with outboard motors and are launched using a one tonne

electro-hydraulic crane, one of which is mounted on each side of the vessel. The vessel is scheduled for a refit in 1985/86 at which time it will be fitted with a rigid, inflatable fast rescue boat.

The vessel is equipped with searchlights and a full range of communications equipment. Immersion suits are carried for 60 persons which respresents about 50% more than the crew complement.

Alert has a small two-bed sick bay, but there is no medical attendant. The standard medical supplies required by all vessels of this class are carried as well as a portable resuscitation kit.

Alert is equipped with firefighting equipment and carries portable pumps.

CCGS Daring Replacement

As was noted earlier, Daring will be replaced in the immediate future with a new vessel which is under construction in Marystown, Newfoundland.

The replacement vessel, known as Hull 35, is a supply vessel hull which is to be outfitted for rescue work.

The vessel is 64.7 meters in length and will be powered by two main engines which develop a total of 7414 hp. Propulsion will be provided by twin variable pitch propellors and the vessel will have a 275 hp bow thruster. The vessel will have joystick control of propulsion machinery.

The vessel will have towing capability and is classed for ice.

The rescue zone on this vessel will be located near midships and the vessel has a freeboard of about .6 meters. Bulwork height in the rescue zone is not known.

Since this vessel is still under construction it is not yet known what rescue equipment will be carried. However, the vessel will be equipped with a rigid man-overboard boat which will be launched using a double davit system. It will also carry a rigid inflatable fast rescue craft with a diesel water jet drive which will be launched using a single davit system.

The particulars of CCGS Daring will not be discussed as this vessel will be retired from service.

Secondary SAR Vessels

In addition to the primary SAR vessels, the SAR system has designated other government vessels as having a secondary SAR role.

These vessels include other Canadian Coast Guard vessels and some of the vessels operated by the Department of Fisheries and Oceans. These vessels are not designed for SAR operations but have had some rescue equipment such as inflatable boats, line-throwing equipment, pumps, etc., placed on board.

The vessels owned by the Department of Fisheries and Oceans are the SAR vessels which are most likely to be involved in an incident involving a MODU because they patrol the Grand Banks and Scotian Shelf.

2.5 SAR CLIENTS

2.5.1 Potential SAR Clients

The potential users of the SAR system can be divided into two broad categories; the crew and passengers of aircraft and the crew and passengers of marine craft which operate in the defined SAR area of responsibility.

As this report is primarily concerned with marine related incidents no attempt will be made to estimate the potential air client population. An estimate of this type would be extremely difficult to make and would be of very questionable accuracy.

An estimate of the potential marine client population in each of the SAR regions can be made, but it must be noted that due to a limited data base only a crude approximation is possible.

The potential marine client population broadly includes all those who earn their living on the sea or who use the water for pleasure. The client groups can be categorized as follows:

a) Canadian domiciled carriers of passengers and freight;
b) Foreign carriers operating between Canadian ports;
c) Foreign carriers operating between Canadian and a foreign port;
d) Carriers operating off the coast but not from a Canadian port;

e) Canadian registered fishermen and vessels;

f) Foreign registered fishermen and vessels;

g) Canadian owned pleasure craft;

h) Foreign owned pleasure craft;

i) Offshore drilling units in Canadian waters.

The amount of data available for each of these categories varies, and in all cases assumptions must be made in order to determine relative activity in each SAR region.

Canadian Domiciled Carriers

The category, Canadian Domiciled Carriers, consists of all Canadian domiciled undertakings engaged in the operation of vessels for the transport of freight and passengers overseas or on inland or coastal waters and charterers of such vessels.

In 1981 a total of 315 Canadian domiciled carriers owned and operated 1995 vessels engaged in these activities[13]. Carriers reporting gross revenues of less than $100,000 for 1980, pleasure craft, fishing operations, defence, and foreign domiciled carriers are not included in these numbers.

Table 2.3 outlines the numbers of crew and passengers carried in each Search and Rescue Region based upon infomration from Statistics Canada (Table C-1).

TABLE 2.3

POTENTIAL CLIENT POPULATION - CANADIAN DOMICILED CARRIERS (1981)

SRR:	CREW	PASSENGERS	TOTAL
Victoria	5,266	20,664,937	20,670,203
Edmonton/Trenton	6,076	5,854,946	5,861,022
Halifax	7,345	4,542,028	4,549,373
TOTAL	18,687	31,061,911	31,080,598

Derived from Table C-1

Assumptions: Pacific and Atlantic regions correspond to Victoria and Halifax SRRs.
: Inland Waters and Arctic and Mackenzie River are included in Trenton/Edmonton SRR.
: "International" has been divided in the same proportion as the numbers of arrivals of Canadian registered vessels engaged in international trade as outlined in Table C-2.

A point to note is the extremely high proportion of passengers to crew. This is largely a reflection of passenger traffic on ferries especially in the Victoria Search and Rescue Region.

The numbers of ferry passengers reflects vessels which carry a large number of people at a time. These ferry voyages are probably of short duration and as such the numbers of crew is probably a better reflection of client population.

Another indicator of activity by Canadian Domiciled carriers is coastwise shipping activity[14] since this comprises a significant proportion of the Canadian Domiciled Carrier's activity.

Table 2.4 outlines arrivals at and departures from ports in each Search and Rescue Region of vessels engaged in coastal shipping activity.

Coastwise vessel traffic is approximately equal in the Halifax and Victoria search and rescue region and slightly lower in the Edmonton/Trenton region.

Foreign Carriers Operating between Canadian Ports

Foreign registered carriers operating in coastal shipping between Canadian ports do not represent a significant client population as illustrated in Table C-3[14]. In 1982, foreign

TABLE 2.4

ARRIVALS AND DEPARTURES OF COASTWISE SHIPPING VESSELS BY SAR REGION (1982)

	ARRIVALS	DEPARTURES	TOTAL MOVEMENTS	% OF NATIONAL TOTAL
Halifax	10,814	10,691	21,505	37.5%
Edmonton/Trenton	8,153	8,090	16,243	28.3%
Victoria	10,181	9,447	19,628	34.2%
TOTAL	29,148	28,228	57,376	100.0%

Derived from Table C-2
Assumptions: All activity in Newfoundland, Nova Scotia, New Brunswick and Prince Edward Island is in the Halifax SRR.
: All activity in Ontario, Quebec, Manitoba and the Northwest Territories is in the Trenton/Edmonton SRR.
: All activity in British Columbia is in the Victoria SRR.

vessels accounted for only 1.5% of the total arrivals and departures between Canadian ports and as such will be ignored in terms of a potential client population.

Foreign Carriers Operating between Canadian and Foreign Ports

Foreign registered vessels operating between a Canadian and a foreign port represent a significant potential client population. Table 2.5 outlines vessel arrivals and departures from Canadian ports in each Search and Rescue Region. The numbers of arrivals and departures in each region indicates that approximately 37% of the activity is in the Victoria SRR, 47% in the Trenton SRR, and 16% in the Halifax SRR[15].

It must be noted, however, that many of the vessels which arrive or depart from the Great Lakes and St. Lawrence must pass through the Halifax SRR. A conservative estimate of the number of vessels which pass through the Halifax SRR to and from these destinations can be made by assuming that all Canadian and U.S. registered vessels arriving and departing from these areas do not pass through the Halifax SRR. That is their point of origin or final destinations is a U.S. port on the St. Lawrence or the Great Lakes. The numbers of Canadian and U.S. vessels are shown on Table C-4.

If this assumption is made then some 8,054 vessels from the St. Lawrence and 1,217 vessels from the Great Lakes traversed the

TABLE 2.5

SAR REGION VESSEL MOVEMENTS; VESSELS TRANSITTING BETWEEN A CANADIAN AND A FOREIGN PORT (1981)

SAR REGION	ARRIVALS & DEPARTURES FROM PORTS IN REGION	TRANSIT	TOTAL	% OF NATIONAL MOVEMENTS
Halifax	8,290	9,271	17,561	29.3%
Trenton	23,593	0	23,593	39.4%
Victoria	18,716	0	18,716	31.3%
TOTAL	50,599	9,271	59,870	100.0.%

Derived from Table C-4
Assumptions: Atlantic Region is in Halifax SRR.
: Great Lakes and St. Lawrence is in Trenton SRR.
: Pacific Region is in Victoria SRR.

Halifax SRR in 1981. If these vessel movements are added to the arrivals and departues in the region, the international vessel traffic totals some 17,561 movements.

Table 2.5 also outlines international vessel movements in each of the search and rescue regions based upon this assumption and indicates that the Halifax and Victoria SRR's experienced approximately the same number of international vessel movements in 1981 while the Trenton region had a slightly higher level of activity.

Carriers Operating off the Coast but not from a Canadian Port

Accurate data on the numbers of vessels operating off the coasts of Canada but which do not center Canadian ports was not available. Transport Canada[16] indicates that this activity is greater off the West Coast than the East Coast.

Canadian Registered Fishermen and Vessels

Canadian registered fishermen present a large potential client group to the SAR system. Table 2.6 outlines the numbers of registered fresh water and sea fishermen by Search and Rescue Region[17].

The table shows that 67.8% of all fishermen in Canada operate in the Halifax region with 22.1% in the Victoria and 10.1% in the Trenton and Edmonton regions.

TABLE 2.6

NUMBER OF REGISTERED FISHERMEN BY SAR REGION (1981)

	FRESH WATER	SEA	TOTAL	% OF NATIONAL TOTAL
Halifax	127	53,250	53,377	67.8%
Trenton	2,560	-	2,560	3.3%
Edmonton	5,369	-	5,369	6.8%
Victoria	-	17,454	17,454	22.1%
TOTAL	8,056	70,704	78,760	100.0%

Derived from Table C-5

Assumptions: Halifax SRR has all fishermen from Newfoundland, Nova Scotia, New Brunswick, Prince Edward Island and sea fishermen from Quebec.

: Trenton SRR has all fishermen from Ontario and freshwater fishermen from Ontario.

: Edmonton SRR has all fishermen from the Prairie Provinces and the Northwest Territories.

: Victoria SRR has all fishermen from British Columbia.

The number of registered fishermen may not be a good indicator of actual fishing actvity as many fishermen are not employed full time in the fisheries. Canadian Fisheries Annual Statistical Review (1981)[17] lists the number of full-time sea fishermen for the Atlantic provinces and Quebec. This information is reproduced in Table 2.7 and shows that 60.4% of the full-time sea fishermen operate in the Halifax region and 39.6% in the Victora region.

The number of registered fishing vessels is another indicator of fishing activity. Table 2.8 outlines the number of fishing vessels by Search and Rescue Region. The number of fishing vessels by SAR regions shows similar proportions to the total number of fishermen in each SAR region with the majority (74.2%) of the vessels in the Halifax region.

It should be noted that the number of deep sea fishing vessels both in the Halifax and Victoria Search and Rescue regions are quite small. Over 90% of the vessels in the Halifax region displace less than 25 tons. No information on vessel tonnages is available for British Columbia but it can be noted that about 80% of the vessels are of less than 40' in length. Table C-7 to C-13 of Annex C contain more information on vessel sizes.

TABLE 2.7

NUMBER OF FULL TIME FISHERMEN BY PROVINCE (1981)

	NUMBER		NUMBER	% OF NATIONAL TOTAL
Newfoundland	13,375			
Nova Scotia	6,953			
Prince Edward Island	1,511	Halifax SRR	26,667	60.4%
New Brunswick	2,452			
Quebec	2,376*			
British Columbia	17,454**	Victoria SRR	17,454	39.6%
TOTAL	44,121		44,121	100.0%

*No information available on defined "full time" fishermen in Quebec. Number used is number of fishermen earning 76% to 100% of income from fishing.

**No information available on number of full time fishermen in British Columbia - all registered fishermen are assumed to be full time.

Source: Canadian Fisheries - Annual Statistical Review 1981

TABLE 2.8

NUMBER OF REGISTERED FISHING VESSELS BY SAR REGION

	FRESHWATER	SEA	TOTAL	% OF NATIONAL TOTAL
Halifax	41	30,945	30,986	74.2%
Trenton	1,534	-	1,534	3.7%
Edmonton	1,976	-	1,976	4.7%
Victoria	-	7,261	7,261	17.4%
TOTAL	3,551	38,206	41,757	100.0%

Derived from Table C-6
Assumptions: Halifax SRR has all vessels in Newfoundland, Nova Scotia, New Brunswick, Prince Edward Island and all sea vessels in Quebec.
: Trenton SRR has all vessels in Ontario and freshwater vessels in Quebec.
: Edmonton SRR has all vessels in Prairie Provinces and the Northwest Territories.
: Victoria SRR has all vessels in British Columbia.

The large number of small fishing vessels in both regions indicates that the majority of the fishing activity takes place relatively close to shore or in protected waters.

Foreign Registered Fishermen and Vessels

The numbers of foreign registered fishing vessels operating off the east coast varies seasonally and from year to year depending upon licencing and fish stocks. The Department of Fisheries and Oceans (DFO)[18] estimates that on average 50 to 60 foreign registered vessels were operating off the East Coast throughout 1983. This number increased to over 100 vessels during the summer months.

The numbers of crew on these vessels varies from a low of about 20 persons to approximately 90 on the larger vessels. DFO estimates that the average crew size throughout the year to be about 40 resulting in a continuous population of 2000-2400 persons with peaks of as high as 4000 persons.

No information was available on the size of the foreign registered fishing fleet of the West Coast of Canada but it is known to be of a much smaller size than that off Eastern Canada.

Canadian Owned Pleasure Craft

Information on pleasure craft activity as it relates to Search and Rescue is very sketchy and can only lead to general conclusions.

Table 2.9 and 2.10 outline the number of small boat licences issued in each search and rescue region from 1974 to 1983[19]. These numbers were derived from Table C-14 in Annex C and include small fishing vessels. Although the numbers of licences issued per year is an accurate figure the numbers cannot be assumed to reflect craft in use, as licences are not de-activated. In addition, many of these craft are operated on inland lakes and rivers where the responsibility for marine related search and rescue lies with the local authorities and not with the SAR system. For example, 20% of the craft registered in 1983 were in the Edmonton SRR where local authorities have responsibility for the vast majority of incidents involving these craft.

The numbers of vessels registered may not reflect the exposure to risk as many vessels will be used on an occasional basis.

The licencing of fishing vessels in the Halifax region could represent a significant proportion of the small vessel licences. Based upon 1981 statistics there were some 24,000 fishing vessels of under 10 tons in the Halifax region. This would significantly reduce the proportion of small boat licences which have been issued for pleasure craft in the region.

TABLE 2.9

NUMBER OF VESSEL LICENCES ISSUED

SAR REGION	BEFORE 1974	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	TOTAL
Halifax	59,443	3,242	3,964	3,728	6,644	6,732	6,538	5,474	6,085	4,535	3,312	109,697
Trenton	716,373	46,228	45,051	43,812	40,650	45,200	43,107	43,735	42,621	39,702	20,937	1,127,416
Edmonton	135,427	10,741	9,627	15,094	14,265	12,256	11,493	11,291	12,837	10,950	7,311	251,292
Victoria	215,164	19,085	16,977	16,186	17,359	10,424	17,425	16,575	14,049	11,645	4,253	359,142
TOTAL	1,126,407	79,296	75,619	78,820	78,918	74,612	78,563	77,075	75,592	66,832	35,813	1,847,547

*Licences are required for vessels over 10 hp. Pleasure craft of over 20 tons and commercial craft of over 15 tons <u>must</u> be registered and not licenced.

Source: Registry of Shipping, Transport Canada

TABLE 2.10

PERCENT VESSEL LICENCES ISSUED BY SAR REGION

SAR REGION	BEFORE 1974	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	TOTAL
Halifax	5.3	4.1	5.2	4.7	8.4	9.0	8.3	7.1	8.1	6.8	9.3	5.9
Trenton	63.6	58.3	59.6	55.6	51.5	60.6	54.9	56.7	56.4	59.4	58.5	61.0
Edmonton	12.0	13.6	12.7	19.2	18.1	16.4	14.6	14.7	17.0	16.4	20.4	13.6
Victoria	19.1	24.0	22.5	20.5	22.0	14.0	22.2	21.5	18.5	17.4	11.8	19.5
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Licences are required for vessels of over 10 hp. Pleasure craft of over 20 tons and commercial craft of over 15 tons <u>must</u> be registered and not licenced.

Source: Registry of Shipping, Transport Canada

The numbers of small fishing vessels, based upon 1981 statistics, do not represent a significant proportion of the small boat licences which have been issued in the Trenton or Victoria regions.

Based upon small boat licences it appears that pleasure craft form the overwhelming majority of the potential clients in the Trenton region, are the largest client group in the Victoria region and form a group comparable to fishing vessels in the Halifax region.

Foreign Owned Pleasure Craft

No data is available on the numbers of foreign owned pleasure craft which operate in the SAR area of responsibility.

Offshore Drilling Units

Offshore drilling takes place in the Halifax, Trenton and Edmonton search and rescue regions. The total number of offshore units operating in the regions as well as the estimated numbers of persons staffing the units are shown in Table 2.11[20].

The units in the Edmonton search and rescue region operate on a seasonal basis with drilling taking place from July to December and as such the number of persons on the units reduces to zero during the remainder of the year. As noted on the table the number of units stated only includes floating structures in

the Edmonton region. Offshore drilling does occur during the remaining months from artificial islands, caisson structures and floating ice platforms.

A total of five offshore units operated in the Trenton SRR (Great Lakes) on a year-around basis. The accommodations on these units are small resulting in the relatively small population.

Of the 17 units which operated in the Halifax SRR only 9 operated on a continuous basis in 1983. Four units operated only during the summer months, three units entered the region midway during the year, and one entered late in the year.

Approximately 40 offshore supply vessels operated off the East Coast of Canada in 1983 in support of the drilling units. Each vessel carries a crew of about 12 for a total of about 500 persons.

Supply vessel and other oil industry related vessel activity in the Edmonton region (Beaufort) is quite high during the summer months with more than 50 vessels and 500 personnel active offshore.

No information was available at the time of writing on supply vessels activity in the Trenton region but if one vessel per unit is assumed the population would be less than 100 persons.

TABLE 2.11

OFFSHORE DRILLING ACTIVITY BY SAR REGION 1983

	NO. OF RIGS	RIG PERSONNEL[4]	NUMBER OF SUPPLY VESSELS	SUPPLY VESSEL PERSONNEL
Halifax	17[1]	1200 - 1500	40	480
Trenton	5[2]	90 - 120	5	100
Edmonton	5[3]	395 - 525	50+	500+
Victoria	-	-	-	-
TOTAL	27	1685 - 2145		

1 4 jackups, 9 semisubmersibles, 4 drillships

2 2 jackups, 3 drillships on Great Lakes

3 4 drillships, 1 other - includes only floating units, does not include artificial islands, caisson structures or floating ice platforms

4 Based upon 75% and 100% of capacities of quarters

Source: Ocean Industry, September 1983

The numbers of persons "at risk" in offshore exploration at any one time in the Halifax SRR is estimated to be about 2,000 which when compared to the number of fishermen, commercial vessel crews and pleasure boaters forms a very small portion of the total client population.

Summary

Pleasure craft appear to constitute the single largest client group nationally. This is particularly true in the Trenton SRR and to a lesser degree in the Victoria region. Even if it is assumed that, the total number of licences issued for small craft to December, 1983, is double the number of craft actually in use, the numbers of craft in the Victoria and Trenton region are an order of magnitude greater than any other activity.

Fishermen present the second largest client group nationally. The numbers of registered fishermen in the Halifax and Victoria regions are much higher than the numbers of crew of Canadian domiciled carriers. Fishermen form a large portion of the total client population in the Halifax region. Total numbers of fishermen are fewer in the Victoria region and due to the large numbers of pleasure craft do not constitute as significant a proportion of the client population.

Commercial vessels of either foreign or Canadian registry appear to be the next largest client group nationally, while offshore drilling represents a very small portion of the total client population.

2.5.2 Historical SAR Clients

The major source of historical data on the users of the SAR system is the SAR statistics[21] (SARSTATS). The SARSTATS record system records incidents in four categories; Air (A), Marine (M), Humanitarian (H), and Civil Assistance (C).

Air incidents are defined as those incidents where the original vehicle of transport of the person(s) in need of assistance was an airborne vehicle regardless of whether the vehicle comes to rest on land or on water.

Marine incidents are defined as those incidents where the original vehicle of transport of the person(s) in need of assistance was a surface or subsurface marine vehicle including air cushioned vehicles when operating over water.

Humanitarian incidents are defined as those incidents where assistance was provided in an emergency not directly related to an air or marine incident to prevent or relieve human suffering.

Civilian Assistance incidents are defined as those incidents where assistance, not necessarily of a humanitarian nature was provided to a civilian authority. This category includes the search for missing persons.

In addition each of the four categories is subdivided into five subcategories as follows:

1. Distress incident in which a SAR primary resource was used.
2. Distress incident in which no SAR primary resource was used.
3. Non distress incidents and false alarms.
4. Temporary distress which required only monitoring.
5. Reactivated Cases.

Since the primary responsibility of the SAR system is the prevention of loss of life in air and marine incidents only the air and marine incident categories which involved actual distress (subcategories 1 and 2) will be considered[22]. These incidents are referred to as M1, M2, A1, A2 incidents.

Table 2.12 shows the numbers of air and marine distress incidents in each of the search and rescue regions from 1975 to 1983. The total number of distress incidents in Canada remained relatively constant from 1978 to 1982 with a slight decrease in 1983. Air incidents comprised an average of 26.4% of the total distress incidents in Canada from 1975 to 1983 indicating that the major user of the SAR system is the marine public.

TABLE 2.12

NUMBER OF DISTRESS INCIDENTS

HALIFAX

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	TOTAL
Marine 1	36	42	33	41	46	46	84	79	67	474
Marine 2	16	11	7	9	16	14	31	64	40	208
MARINE TOTAL	52	53	40	50	62	60	115	143	107	682
Air 1	13	17	15	20	10	8	21	10	14	128
Air 2	8	3	1	1	1	4	4	4	3	29
AIR TOTAL	21	20	16	21	11	12	25	14	17	157
TOTAL DISTRESS	73	73	56	71	73	72	140	157	124	839

TRENTON

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	TOTAL
Marine 1	106	45	60	61	77	77	67	73	54	620
Marine 2	69	28	56	41	32	33	39	29	41	368
MARINE TOTAL	175	73	116	102	109	110	106	102	95	988
Air 1	43	29	25	33	29	22	24	13	17	235
Air 2	24	14	22	20	20	19	9	8	8	144
AIR TOTAL	67	43	47	53	49	41	33	21	25	379
TOTAL DISTRESS	242	116	163	155	158	151	139	123	120	1367

EDMONTON

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	TOTAL
Marine 1	0	0	0	2	1	4	2	1	2	12
Marine 2	0	0	0	0	0	1	1	0	0	2
MARINE TOTAL	0	0	0	2	1	5	3	1	2	14
Air 1	22	25	22	26	24	12	19	17	12	179
Air 2	21	8	16	6	9	8	5	0	1	74
AIR TOTAL	43	33	38	32	33	20	24	17	13	253
TOTAL DISTRESS	43	33	38	34	34	25	27	18	15	267

TABLE 2.12
(cont'd)

NUMBER OF DISTRESS INCIDENTS (cont'd)

VICTORIA

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	TOTAL
Marine 1	136	89	105	129	131	165	129	135	127	1146
Marine 2	81	50	37	73	74	78	62	54	47	556
MARINE TOTAL	217	139	142	202	205	243	191	189	174	1702
Air 1	23	29	30	37	20	27	26	31	25	248
Air 2	20	13	17	26	38	31	21	6	11	183
AIR TOTAL	43	42	47	63	58	58	47	37	36	431
TOTAL DISTRESS	260	181	189	265	263	301	238	226	210	2133

NATIONAL

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	TOTAL
Marine 1	278	176	198	233	255	292	282	288	250	2252
Marine 2	166	89	100	123	122	126	133	147	128	1134
MARINE TOTAL	444	265	298	356	377	418	415	435	378	3386
Air 1	101	100	92	116	83	69	90	71	68	790
Air 2	73	38	56	53	68	62	39	18	23	430
AIR TOTAL	174	138	148	169	151	131	129	89	91	1220
TOTAL DISTRESS	618	403	446	525	528	549	544	524	469	4606

Source: DND SARSTATS

The geographic distribution of SAR clients (Table 2.13) has changed somewhat over the 1975 to 1983 timeframe. Distress incidents in the Halifax region have risen from an average of 13.6% of the national total during 1975 to 1980 to an average of 27.4% of the national total from 1981 to 1983. This increase in the number of distresses in the Halifax region has been offset by slight decreases in the numbers of distresses in each of the other SAR regions.

SAR Air Clients

Potential air clients consist of the passengers and crew of all aircraft in the SAR area of responsibility. The SARSTATS categorize these aircraft according to ownership. Table 2.14 shows the numbers of air distress incidents which involved private or commercial aircraft. The category "other/unknown" includes government aircraft and incidents where no information on ownership was recorded.

Nationally private aircraft have been involved in the greatest number of incidents but commercial aircraft comprise almost as large a client group. The ratio of private to commercial aircraft incidents vaies from region to region but it should be noted that the majority of all air incidents involve small aircraft whether they be privately owned or commercial.

TABLE 2.13

DISTRESS INCIDENTS AS A % OF THE NATIONAL TOTAL
(M1+M2, A1+A2)

HALIFAX

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVG.
Air	3.4	5.0	3.6	4.0	2.1	2.2	4.6	2.7	3.6	3.4
Marine	8.4	13.1	9.0	9.5	11.7	10.9	21.1	27.3	22.8	14.8
TOTAL	11.8	18.1	12.6	13.5	13.8	13.1	25.7	30.0	26.4	18.2

TRENTON

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVG.
Air	10.8	10.7	10.6	10.1	9.3	7.5	6.1	4.0	5.3	8.2
Marine	28.3	18.1	26.0	19.4	20.6	20.0	19.5	19.5	20.3	21.5
TOTAL	39.1	28.8	36.6	29.5	29.9	27.5	25.6	23.5	25.6	29.7

EDMONTON

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVG.
Air	7.0	8.2	8.5	6.1	6.3	3.6	4.4	3.2	2.8	5.5
Marine	0	0	0	.4	.2	1.0	.6	.2	.4	.3
TOTAL	7.0	8.2	8.5	6.5	6.5	4.6	5.0	3.4	3.2	5.8

VICTORIA

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVG.
Air	7.0	10.4	10.5	12.0	11.0	10.6	8.6	7.0	7.7	9.3
Marine	35.1	34.5	31.8	38.5	38.8	44.2	35.1	36.1	37.1	37.0
TOTAL	42.1	44.9	42.3	50.5	49.8	54.8	43.7	43.1	44.8	46.3

NATIONAL

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVG.
Air	28.2	34.3	33.2	32.2	28.7	23.9	23.7	17.0	19.4	26.4
Marine	71.8	65.7	66.8	67.8	71.3	76.1	76.3	83.0	80.6	73.6
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: DND SARSTATS

TABLE 2.14

AIR INCIDENTS (A1, A2) BY OWNERSHIP

HALIFAX

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	TOTAL
Private	9	9	12	20	11	7	9	2	8	87
Commercial	5	3	0	0	0	2	10	5	6	31
Other/Unknown	7	8	4	1	0	3	6	7	3	39
Total	21	20	16	21	11	12	25	14	17	157

TRENTON

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	TOTAL
Private	23	17	20	25	16	13	11	9	9	143
Commercial	20	18	21	23	27	23	20	11	13	176
Other/Unknown	24	8	6	5	6	5	2	1	3	60
Total	67	43	47	53	49	41	33	21	25	379

EDMONTON

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	TOTAL
Private	31	28	35	30	33	14	7	5	7	190
Commercial	8	4	0	1	0	4	17	11	6	51
Other/Unknown	4	1	3	1	0	2	0	1	0	12
Total	43	33	38	32	33	20	24	17	13	253

VICTORIA

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	TOTAL
Private	14	17	16	24	19	21	15	15	21	162
Commercial	18	21	27	33	27	25	29	19	13	212
Other/Unknown	11	4	4	6	12	12	3	3	2	57
Total	43	42	47	63	58	58	47	37	36	431

TABLE 2.14
(cont'd)

AIR INCIDENTS (A1, A2) BY OWNERSHIP (cont'd)

NATIONAL

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	TOTAL
Private	77	71	83	99	79	55	42	31	45	582
Commercial	51	46	48	57	54	54	76	46	38	470
Other/Unknown	46	21	17	13	18	22	11	12	8	168
Total	174	138	148	169	151	131	129	89	91	1220

Source: DND SARSTATS

SAR Marine Clients

The potential SAR Marine clients in Canada were outlined in Section 2.5.1 along with the relative activity in each SAR region. As indicated in Table 2.15 the Victoria region recorded approximately 50% of the marine distress incidents during the period 1975 to 1983. The final three years (1981-1983) in the table however, indicates that marine distress incidents in the Halifax region have risen from approximately 15% of the national total in 1975 to 1980 to 30% in 1981 to 1983.

Information on SAR clients is available through the SARSTATS but this information is not compiled in the same manner as SAR clients were outlined in Section 2.5.1. Table 2.16 outlines historical marine distress incidents in the Halifax, Trenton and Victoria regions for the years 1976 to 1982 utilizing the categories: commercial, pleasure, fishing and other.

The commercial category includes; Canadian domiciled carriers of passengers and freight, foreign carriers operating between Canadian ports, foreign carriers operating between a Canadian and a foreign port, carriers operating off the coast but not from a Canadian port and offshore drilling units in Canadian waters.

The pleasure craft category includes both Canadian and foreign registered pleasure craft.

TABLE 2.15

% MARINE DISTRESS INCIDENTS BY AREA

(M1+M2)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVG.
Halifax	11.7	20.0	13.4	14.0	16.4	14.4	27.7	32.9	28.3	20.1
Trenton	39.4	27.6	38.9	28.7	28.9	26.3	25.6	23.5	25.1	29.2
Edmonton	0	0	0	.6	.3	1.2	.7	.2	.5	.4
Victoria	48.9	52.4	47.7	56.7	54.4	58.1	46.0	43.4	46.1	50.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: DND SARSTATS

TABLE 2.16

MARINE DISTRESS INCIDENTS (M1 + M2) BY VESSEL TYPE

HALIFAX

	1976-1980		1981	1982	1976-1982		
	NO OF INC	INC/YR	NO OF INC	NO OF INC	NO OF INC	INC/YR AVG	% OF REGION
COMMERCIAL	29	5.8	12	11	52	7.4	9.9
FISHING	113	22.6	56	78	247	35.3	47.2
PLEASURE	54	10.8	24	38	116	16.6	22.2
OTHER	69	13.8	23	16	108	15.4	20.7
TOTAL	265	53.0	115	143	523	74.7	100.0

TRENTON

	1976-1980		1981	1982	1976-1982		
	NO OF INC	INC/YR	NO OF INC	NO OF INC	NO OF INC	INC/YR AVG	% OF REGION
COMMERCIAL	18	3.6	5	3	26	3.7	3.6
FISHING	18	3.6	2	3	23	3.3	3.2
PLEASURE	428	85.6	90	90	608	86.9	84.7
OTHER	46	9.2	9	6	61	8.7	8.5
TOTAL	510	102.0	106	102	718	102.6	100.0

VICTORIA

	1976-1980		1981	1982	1976-1982		
	NO OF INC	INC/YR	NO OF INC	NO OF INC	NO OF INC	INC/YR AVG	% OF REGION
COMMERCIAL	40	8.0	12	8	60	8.6	4.6
FISHING	332	66.4	66	67	465	66.4	35.4
PLEASURE	520	104.0	110	109	739	105.6	56.4
OTHER	39	7.8	3	5	47	6.7	3.6
TOTAL	931	186.2	191	189	1311	187.3	100.0

Sources: DND SARSTATS, Report on an Evaluation of Search and Rescue

The fishing category includes both Canadian and foreign registered fishing vessels.

The category entitled "other" includes incidents involving small open boats, which are neither fishing vessels nor pleasure craft, cases where the identity of the vessel could not be determined, and other miscellaneous watercraft such as windsurfers, canoes, etc.

Data was not available at the time of writing for the years 1975 and 1983 and only averaged data was available for the 1976-1980 time period. The Edmonton region was not considered due to the extremely low occurance of marine incidents in the region.

As indicated in Section 2.5.1 pleasure craft constitute the largest potential client group. Historical distress incident data indicates that pleasure craft are also the largest users of the SAR system. Incidents involving pleasure craft accounted for 57% of all marine distress incidents from 1976 to 1982.

The large pleasure craft population in the Trenton and Victoria regions are also reflected in the historical data. Pleasure craft account for 85% of the distress incidents in the Trenton region and 56% in the Victoria region. It should be noted, however, that the Victoria region experiences more pleasure craft incidents per year than Trenton even though the

pleasure craft population appears to be higher in the Trenton region. The Halifax regon, with its fewer numbers of pleasure craft experiences a relatively low frequency of pleasure craft incidents and these vessels constitute only 22% of the distress incidents in the region.

Fishing vessels, as their population would indicate, are the other large users of the SAR system on a national basis. 47% of the incidents in the Halifax region and 35% of the incidents in the Victoria region involve fishing vessels. It is interesting to note that although the Halifax region has a greater number of fishing vessels the Victoria region experienced an average incident frequency, over the six years examined, of almost double that of the Halifax region. However, the incident frequencies involving fishing vessels during 1981 and 1982 for the two regions were about equal. Historically, commerical vessels have not represented a large proportion of the SAR users. During the period 1976 to 1982 commercial vessels were involved in only 5.4% of the distress incidents nationally. Commercial vessel incidents represented less than 10% of the marine distress incidents in any of the SAR regions. The average frequency of commercial vessel incidents during the six years examined was approximately equal in the Victoria and Halifax regions but again the Halifax regions shows an increased frequency for 1981 and 1982.

Summary

Historical data indicates that the majority of the distress incidents involve marine craft rather than aircraft. Pleasure craft and fishing vessels are involved in the majority of the marine distress incidents with pleasure craft representing the largest numbers of incidents in the Victoria and Trenton regions. Fishing vessels are involved in the largest percentage of incidents in the Halifax region and also constitute a significant percentage of the incidents in the Victoria region.

Commercial vessels do not represent a large portion of the historical distress incidents and account for approximately 20 incidents per year nationally.

2.6 SAR RESOURCE DEPLOYMENT

2.6.1 Current Resource Deployment

The SAR system currently operates 42 vessels and 24 aircraft whose primary role is Search and Rescue. Primary SAR vessels are owned and operated by the Canadian Coast Guard while the Department of National Defense owns and operates all primary air resources. In addition other federal departments have designated some or all of their resources as having a secondary SAR role. These include:

- Department of National Defense (vessels and aircraft)
- Canadian Coast Guard (vessels and aircraft)
- Department of Fisheries and Oceans (vessels)

Provincially sponsored groups and volunteer organizations also provide SAR assistance. Air organizations in British Columbia (PEP), Alberta (CARES), Saskatchewan (SEMAD), Manitoba (MACI) and in some cities in Eastern Canada provide spotters and aircraft with pilots to participate in searches. These organizations are coordinated by CASARA, the Canadian Air Search and Rescue Auxiliary.

Volunteers also provide the use of their boats and services for marine SAR in the Victoria, Trenton and Halifax regions; they are coordinated nationally by CMRA, the Canadian Marine Rescue Auxiliary.

In discussing resource deployment only dedicated primary resources will be considered.

Marine Resources

Table 2.17 lists the size and numbers of primary SAR vessels in each Search and Rescue Region. In addition to the resources listed inland rescue boats are operated in several locations during the summer months.

Air Resources

Table 2.18 lists the primary SAR aircraft in each Search and Rescue Region. It should be noted that the helicopter squadron at Summerside has one Voyageur helicopter which has not been converted to the SARCUP configuration. This conversion is scheduled to be completed by June 1984.

The Edmonton and Trenton regions only list one Hercules and one Buffalo respectively. This listing is a reflection of the number of this type of aircraft dedicated to SAR continuously. The Trenton Squadron has several Buffalo and the Edmonton region several Hercules aircraft. The practise is to designate only one of the aircraft available at a time as the primary SAR aircraft although in fact several aircraft may be available for SAR duties if needed.

TABLE 2.17
SAR PRIMARY MARINE RESOURCES

	TYPE	NAME	BASE	LENGTH	CONST.	CREW	REMARKS
Halifax SRR	600	Alert	Dartmouth, NS	71.4	Steel	35	
	600	Daring	Dartmouth, NS	54.25	Steel	27	
*	600	Grenfell	St. John's, NF	56.1	Steel	16	
*	600	Jackman	St. John's, NF	56.1	Steel	16	
	300	#101	Souris, PEI	13.4	Steel	3	Self-righting
	300	#102	West Port, NS	13.4	Steel	3	Self-righting
*	300	#103	Bickerton E, NS	13.4	Steel	3	Self-righting
	300	#107	Burin, NF	13.4	Steel	3	Self-righting
	300	#114	Burgeo, NF	13.4	Steel	3	Self-righting
	300	#115	Shippigan, NB	13.4	Steel	3	Self-righting
	300	#116	Clark's Hbr., NS	13.4	Steel	3	Self-righting
	300	#117	Sambro, NS	13.4	Steel	3	Self-righting
	300	#118	Louisburg, NS	13.4	Steel	3	Self-righting
	300	#140	Port Mouton, NS	13.4	Steel	3	Self-righting
	300	#141	Grindstone, PQ	13.4	Steel	3	Self-righting
Trenton SRR	500	Villemarie	Quebec, PQ	40.9	Steel	16	
	400	#124	Tadoussac, PQ	21.6	Aluminum	5	
	400	#126	Godrich, ON	21.6	Aluminum	5	
	400	Spindrift	Cobourg, ON	21.3	Wood	4	
	400	Spray	Port Dover, ON	21.3	Wood	4	
	400	Spume	Meaford, ON	21.3	Wood	4	
	300	#108	Tobermory, ON	13.4	Steel	3	Self-righting
	300	#109	Thunder Bay, ON	13.4	Steel	3	Self-righting
	100	#119	St. Catherines, ON	12.27	Steel	3	
	100	#120	Amherstburg, ON	9.4	Fiberglass	3	
	100	#157	Kingston, ON	12.4	Aluminum	3	
	100	#98	Quebec, PQ	10.9	Steel	3	

SAR PRIMARY MARINE RESOURCES (CONT'D.)

	TYPE	NAME	BASE	LENGTH	CONST.	CREW	REMARKS
Victoria SRR	600	G.E. Darby	Victoria, BC	56.1	Steel	16	
	500	Racer	Victoria, BC	29.0	Steel	12	
	500	Rider	Vancouver, BC	29.0	Steel	12	
	400	#123	Prince Rupert, BC	21.6	Fiberglass	5	
	400	#125	Campbell River, BC	21.6	Aluminum	5	
	350	#021	Sea Island, BC	11.8	Aluminum	3	Hovercraft
	350	#039	Sea Island, BC	14.76	Aluminum	3	Hovercraft
	350	#045	Parksville, BC	14.76	Aluminum	3	Hovercraft
	300	#104	Bamfield, BC	13.4	Steel	3	Self-righting
	300	#105	Tofino, BC	13.4	Steel	3	Self-righting
	300	#106	Bull Harbour, BC	13.4	Steel	3	Self-righting
	100	#122	Ganges, BC	13.5	Aluminum	3	
	100	#156	Kitsilano, BC	12.2	Aluminum	3	
	100	Relite	Powell River	11.3	Fiberglass	1	Volunteer Crew
	100	Swift	Kitsilano, BC	8.13	Aluminum	3	

Source: Canadian Coast Guard

TABLE 2.18

SAR PRIMARY AIR RESOURCES

	TYPE RESOURCE	RES. NAME	NUMBER	BASE	SQN. #
Halifax SRR	Helicopter	SARCUP	2	Summerside, PEI	413
	Helicopter	Voyageur	1	Summerside, PEI	413
	Fixed Wing	Buffalo	3	Summerside, PEI	413
	Helicopter	SARCUP	3	Gander, NF	103
Trenton SRR	Helicopter	Twin Huey	3	Trenton, ON	424
	Fixed Wing	Buffalo	1	Trenton, ON	424
Edmonton SRR	Fixed Wing	Twin Other	3	Edmonton, AB	440
	Fixed Wing	Hercules	1	Edmonton, AB	440
Victoria SRR	Helicopter	SARCUP	4	Comox, BC	442
	Fixed Wing	Buffalo	3	Comox, BC	442

Source: Department of National Defence

2.6.2 Basis of Resource Deployment

The basis for the current distribution of individual SAR resources cannot be stated explicitly as the justifications for individual resources varies according to area and circumstances. In general, however, the following factors dominate when considering the deployent of primary SAR resources:

a) proximity to historical occurrences of SAR distress incidents;

b) potential SAR client population, i.e. lives at risk;

c) airfield weather/operating limits;

d) support infrastructure;

e) alternate sources of Search and Rescue support.

Proximity to SAR Incidents

The proximity to distress incidents is the major factor in the deployment of primary SAR resources as evidenced in three studies of the SAR system. A 1982 study entitled "A Review on Search and Rescue in the Halifax SRR"[23] states "Since actual distress cases are instances in which help was required to save lives they represent that portion of statistics which is most effective in planning the deployment of SAR resources". Two studies completed in 1980 entitled "A Study of SAR Helicopter Response"[22] and "A Study of SAR Fixed Wing Aircraft Response"[24] both state that "Analysis of SAR requirements in this study have been limited to air and marine distress cases because an adequate response capability for distress incidents will also satisfy the response requirements for non-distress incidents. Further, the

principal responsibility of DND lies with the resolution of air and marine distress incidents".

Clearly the occurrence of air and marine distress incidents is a major factor in the deployment of resources. Non-distress incidents and incidents of a humanitarian or civil nature whether they be distress or non-distress are not considered in resource deployment.

Potential SAR Client Population

The potential SAR client population is not a major factor in the overall deployment of primary resources. The total numbers of persons at risk in distress incidents nor the average number per incident are used in determining resource deployment. Similarly historical data on lives lost vs persons on board are not generally used as indicators of the effectiveness of resource deployment. This is largely due to uncertainty as to the numbers of people initially on board who were lost prior to notification of the SAR system or whose death could not be attributed to a failure of the SAR system to effect their rescue.

The main reaction of the SAR system, in terms of resource deployment, to potential client population occurs on a regional basis. SAR resources are redeployed within regions in anticipation of annual client population shifts. For example, primary SAR vessels are redeployed in the Halifax region in anticipation of a demand due to the annual seal hunt and in the Victoria region during the herring roe fishery.

Airfield Weather/Operating Limit

Weather/operating limits are a major factor in the deployment of air resources. Factors such as weather records, navigational aids and terrain are considered in the siting of aircraft in an attempt to ensure that aircraft can operate a high percentage of the time.

Support Infastructure

The requirement for a substantial support infastructure is a major consideration in the deployment of primary SAR air resources. Hangers, offices, living accommodations, storage space and administrative and maintenance personnel are required to support SAR aircraft. These facilities may not be available at all locations in close proximity to distress incident concentrations.

Alternate Sources of Search & Rescue Support

The presence of alternate sources of search and rescue support affects the deployment of primary SAR resources. This is generally not a major factor in the deployment of air resources but is more important for marine resources. The presence of groups such as the Canadian Marine Rescue Auxiliary in some areas has alleviated the need to deploy SAR vessels.

2.6.3 Analysis of Current Deployment

Resource deployment will be analysed nationally, and on a regional basis only within the Halifax Search and Rescue region. Since it is unlikely that primary marine resources would be involved in the rescue of personnel from drilling operations the focus of this analysis will be primary air resources. Marine resources will be considered to the extent that they compliment air resources.

National Deployment

Table 2.12 outlined the occurrences of distress incidents in each search and rescue region. As has been noted the frequency of these incidents shows a marked anonomoly in the large increase in distress incidents in the Halifax region during the past three years.

The Victoria region has experienced the largest number of distress incidents, averaging 225 incidents per year (1981-83). The Halifax and Trenton regions experience about 140 and 130 incidents per year respectively while Edmonton experiences approximately 20 per year. Over 80% of the distress incidents in all regions except the Edmonton region are marine distress incidents.

By definition primary resources are only utilized in what is termed as Category 1 incidents (M1, A1). An indication of the utilization of primary resources can be gained by examining the number of distress incidents in which primary air and marine resources were used (Table 2.19).

The number of distress incidents in which primary air or primary marine resources were used remained relatively stable in all regions except the Halifax region. Primary air resources participated in an average of 50.5 and 52.7 incidents per year in the Halifax and Victoria regions from 1975 to 1983. This average is somewhat misleading in the Halifax region, as there is a marked increase during 1982 to 1983. From 1975 to 1980 primary air resources participated in an average of 45.5 incidents per year while in 1981 to 1983 this rose to 60.6 incidents per year. Despite the fact that the Victoria region has a higher occurrance of distress incidents, primary air resources in the Halifax region have participated in more incidents in the last three years.

Primary air resources participated in 54% of the distress incidents in the Halifax region from 1975 to 1983 compared to 29% for Trenton and 22% for Victoria. Edmonton experienced the highest utilization at 68% of all distress cases.

TABLE 2.19
RESOURCE PARTICIPATION IN DISTRESS INCIDENTS

HALIFAX

	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
Primary Air	39	53	40	53	46	42	72	53	57	50.5
Primary Marine	18	18	19	21	25	25	61	53	45	31.7

TRENTON

	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
Primary Air	66	46	32	51	52	47	41	40	25	44.4
Primary Marine	90	32	57	52	64	69	59	65	50	59.8

EDMONTON

	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
Primary Air	22	25	22	28	24	13	20	17	12	20.3
Primary Marine				1	1	3	1	1	2	1.0

VICTORIA

	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
Primary Air	55	53	47	59	42	67	49	56	46	52.7
Primary Marine	123	88	104	136	132	160	127	133	132	126.1

* NOTE - Numbers will not add to total number of A1 and M1 incidents as some incidents utilized both Air & Marine resources.

Source: DND SARSTATS

Primary marine resource utilization was highest in the Victoria region where these craft participated in an average of 126 incidents per year or 53% of the incidents. Primary marine craft participated in 39% and 34% of the incidents in the Trenton and Halifax regions. Participation of primary marine vessels in the Halifax region shows a marked increase during the past three years. Primary marine craft participated in an average of 21 incidents per year from 1975 to 1980 and 53 incidents per year from 1981 to 1983. This is still significantly lower than the useage in the Victoria region and somewhat lower than in the Trenton region.

Based upon the number of incidents where primary air and marine resources were utilized it would appear that primary air resource utilization in the Halifax and Victoria regions is about equal. However, if the flying hours expended by primary aircraft in each region are compared this no longer holds true. Table 2.20 indicates that the Victoria region accounted for 39.5% of the hours flown by primary aircraft nationally, while the Edmonton, Halifax, and Trenton regions accounted for 26.8%, 19.1% and 14.6% respectively. This anomaly between the number of incidents in which primary aircraft were utilized and the flying hours is due primarily to the long search times required for air incidents in the Victoria and Edmonton regions. Nationally over 80% of the primary air resource flying hours were expended on air incidents even though these incidents only consitituted 26% of the total

TABLE 2.20
FLYING HOURS AS A % OF NAT. TOTAL - ALL PRIMARY AIRCRAFT

HALIFAX

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	9.6	20.6	6.8	5.1	18.3	9.4	6.4	3.2	3.1	9.0
MARINE	4.4	11.2	11.3	12.6	6.9	13.9	9.4	11.1	11.0	10.1
TOTAL	14.0	31.8	18.1	17.7	25.2	23.3	15.8	14.3	14.1	19.1

TRENTON

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	16.7	11.6	16.6	9.5	11.8	19.3	14.5	4.1	8.5	11.9
MARINE	3.0	2.4	.9	3.7	4.0	4.5	1.8	2.3	1.8	2.7
TOTAL	19.7	14.0	17.5	13.2	15.8	23.8	16.3	6.4	10.3	14.6

EDMONTON

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	33.4	16.5	36.1	19.4	28.3	21.9	26.8	41.6	6.1	26.7
MARINE	0	0	0	.3	0	.3	.2	0	0	.1
TOTAL	33.4	16.5	36.1	19.7	28.3	22.2	27.0	41.6	6.1	26.8

VICTORIA

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	28.2	34.1	21.6	43.1	25.7	16.8	36.9	34.2	64.1	34.1
MARINE	4.7	3.6	6.7	6.3	5.0	13.9	4.0	3.5	5.4	5.4
TOTAL	32.9	37.7	28.3	49.4	30.7	30.7	40.9	37.7	69.5	39.5

NATIONAL

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	87.9	82.8	81.1	77.1	84.1	67.4	84.6	83.1	81.8	81.7
MARINE	12.1	17.2	18.9	22.9	15.9	32.6	15.4	16.9	18.2	18.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: DND SARSTATS

distress incidents. The only region where flying hours expended for marine distress incidents exceeded those for air distress incidents was the Halifax region. Interestingly the number of flying hours in the Halifax region does not exhibit the same increase in 1981 to 1983 as was noted previously.

The flying hours for primary aircraft have been further separated into fixed wing and rotary wing aircraft in Tables 2.21 and 2.22. The Edmonton and Victoria regions experienced a much greater percentage of the national flying hours for primary fixed wing aircraft (37.9% and 37.3% respectively) than did the Halifax (15.3%) and Trenton (9.5%) regions.

In terms of primary rotary wing aircraft, Victoria again experienced the highest percentage (44.2%) followed by Halifax (26.8%) and Trenton (24.5%).

Table 2.23 outlines the flying times of primary, secondary and non-SAR aircraft in each region as a percentage of the total flying hours for each aircraft category. The high utilization of secondary aircraft in the Trenton and Edmonton regions is a reflection of the squadrons of Buffalo and Hercules aircraft stationed in the regions.

Non-SAR aircraft useage is highest in the Victoria and Edmonton regions and is extremely limited in the Halifax region. This is partially a reflection of the civilian aid groups which operate in Western Canada.

TABLE 2.21

FLYING HOURS AS A % OF NAT. TOTAL - PRIMARY FIXED WING AIRCRAFT

HALIFAX

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	6.9	20.7	6.0	4.6	14.6	8.7	4.2	1.7	2.1	7.5
MARINE	4.1	10.8	8.1	9.7	3.2	9.8	7.7	9.2	8.7	7.8
TOTAL	11.0	31.5	14.1	14.3	17.8	18.5	11.9	10.9	10.8	15.3

TRENTON

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	15.9	5.8	11.9	5.8	7.2	13.9	7.8	2.6	5.8	8.0
MARINE	2.4	.7	.1	1.7	3.0	2.9	.9	1.0	1.1	1.5
TOTAL	18.3	6.5	12.0	7.5	10.2	16.8	8.7	3.6	6.9	9.5

EDMONTON

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	43.2	24.4	47.7	30.0	40.6	35.3	42.6	51.3	9.2	37.8
MARINE	-	-	-	.5	-	.4	.3	-	-	.1
TOTAL	43.2	24.4	47.7	30.5	40.6	35.7	42.9	51.3	9.2	37.9

VICTORIA

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	24.4	34.6	21.3	42.4	27.9	17.7	32.7	31.7	69.5	33.1
MARINE	3.1	3.0	4.9	5.3	3.5	11.3	3.8	2.5	3.6	4.2
TOTAL	27.5	37.6	26.2	47.7	31.4	29.0	36.5	34.2	73.1	37.3

NATIONAL

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	90.4	85.5	86.9	82.8	90.3	75.6	87.3	87.3	86.6	86.4
MARINE	9.6	14.5	13.1	17.2	9.7	24.4	12.7	12.7	13.4	13.6
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: DND SARSTATS

TABLE 2.22

FLYING HOURS AS A % OF NAT. TOTAL - PRIMARY ROTARY WING AIRCRAFT

HALIFAX

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	18.8	20.3	8.3	5.9	26.9	10.5	10.2	6.9	4.7	12.0
MARINE	5.5	12.0	17.2	17.5	15.5	20.6	12.3	15.9	14.8	14.8
TOTAL	24.3	32.3	25.5	23.4	42.4	31.1	22.5	22.8	19.5	26.8

TRENTON

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	19.0	21.6	25.5	15.8	22.3	28.2	25.8	7.9	12.7	19.5
MARINE	5.0	5.3	2.4	7.4	6.3	7.2	3.4	5.5	2.9	5.0
TOTAL	24.0	26.9	27.9	23.2	28.6	35.4	29.2	13.4	15.6	24.5

EDMONTON

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	.3	3.0	14.4	.9	0	0	0	17.0	1.2	4.5
MARINE	0	0	0	0	0	0	0	0	0	0
TOTAL	.3	3.0	14.4	.9	0	0	0	17.0	1.2	4.5

VICTORIA

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	41.5	33.2	22.2	44.5	20.7	15.3	44.0	40.8	55.5	36.2
MARINE	9.9	4.6	10.0	8.0	8.3	18.2	4.3	6.0	8.2	8.0
TOTAL	51.4	37.8	32.2	52.5	29.0	33.5	48.3	46.8	63.7	44.2

NATIONAL

CATEGORY	1975	1976	1977	1978	1979	1980	1981	1982	1983	AVERAGE
AIR	79.6	78.1	70.4	67.1	69.9	54.0	80.0	72.6	74.1	72.2
MARINE	20.4	21.9	29.6	32.9	30.1	46.0	20.0	27.4	25.9	27.8
TOTAL	99.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: DND SARSTATS

TABLE 2.23

FLYING HOURS AS A % OF TOTAL FLYING HOURS FOR EACH AIRCRAFT CATEGORY

Average 1975-1983

		HALIFAX	TRENTON	EDMONTON	VICTORIA	NATIONAL
PRIMARY AIRCRAFT	AIR	9.0%	11.9%	26.7%	34.1%	81.7%
	MARINE	10.1%	2.7%	.1%	5.4%	18.3%
	TOTAL	19.1%	14.6%	26.8%	39.5%	100.0%
SECONDARY AIRCRAFT	AIR	4.9%	29.4%	29.8%	17.4%	81.5%
	MARINE	11.1%	1.1%	.1%	6.2%	18.5%
	TOTAL	16.0%	30.5%	29.9%	23.6%	100.0%
OTHER (NON-SAR) AIRCRAFT	AIR	1.1%	10.5%	29.4%	50.9%	91.9%
	MARINE	1.8%	3.5%	-	2.8%	8.1%
	TOTAL	2.9%	14.0%	29.4%	53.7%	100.0%
ALL AIRCRAFT	AIR	6.3%	14.8%	28.0%	35.0%	84.1%
	MARINE	8.3%	2.6%	-	5.0%	15.9%
	TOTAL	14.6%	17.4%	28.0%	40.0%	100.0%

Source: DND SARSTATS

Table 2.24 and Table 2.25 summarizes the average aircraft useage in each category for the period 1975 to 1983. Actual hours flown by each type of aircraft are shown in Tables D1 to D6 of Annex D.

An examination of the hours expended on distress incidents by primary SAR vessels as a percentage of the Primary SAR vessel hours expended nationally (Table 2.26) indicates that vessel useage was highest in the Victoria region which accounted for 47.9% of the hours expended from 1975 to 1983. It is followed by the Halifax and Trenton regions at 31% and 20.4% respectively. Primary vessel hours expended per year remained relatively stable in the Victoria and Trenton regions but the Halifax region demonstrates a significant increase from 1981 to 1983. Primary vessels averaged 282 hours per year on distress incidents or 24.9% of the hours expended by Primary SAR vessels nationally from 1975 to 1980. This increased to an average of 548 hours per year in 1981 to 1983 which is approximately the same level as the Victoria region (573 hours per year 1975 to 1983) and represents 41.8% of the hours expended by Primary SAR vessels nationally for the time period.

Secondary SAR vessels expended the greatest number of hours on distress incidents in the Halifax region averaging 62.8% of the hours expended by Secondary SAR vessels nationally. The

TABLE 2.24

AVERAGE AIRCRAFT USEAGE

	HALIFAX		TRENTON		EDMONTON		VICTORIA		NATIONAL	
	75-80	81-83	75-80	81-83	75-80	81-83	75-80	81-83	75-80	81-83
vg. No. of Distress Inc/Year	69.7	140.3	164.2	127.3	34.5	20.0	243.2	224.7	511.6	512.3
rimary Air Used Inc/Year	45.5	60.7	49.0	35.3	22.3	16.3	53.8	50.3	170.6	162.6
rs/Year All Aircraft	1237.9	908.6	1487.4	1047.3	2081.9	2321.6	2454.5	4338.4	7261.7	8615.9
rs/Year Primary Aircraft	913.4	700.3	706.6	504.7	1094.3	1357.9	1520.2	2183.0	4234.5	4745.9
rs/Year Secondary Aircraft	278.9	135.5	520.7	280.0	468.7	358.0	299.4	424.1	1567.7	1197.6
rs/Year Non-SAR Aircraft	45.6	72.9	260.1	262.6	518.9	605.8	634.9	1731.3	1459.5	2672.6

Source: DND SARSTATS

TABLE 2.25

AIRCRAFT HOURS AS A % OF TOTAL AIRCRAFT HOURS
AVERAGE 1975 - 1983

	HALIFAX	TRENTON	EDMONTON	VICTORIA	NATIONAL
Primary Aircraft	10.9	8.3	15.3	22.6	57.1
Secondary Aircraft	3.0	5.7	5.6	4.4	18.7
Non-SAR Aircraft	.7	3.4	7.1	13.0	24.2
Total	14.6	17.4	28.0	40.0	100.0

Source: DND SARSTATS

TABLE 2.26

VESSEL HOURS AS A % OF NATIONAL TOTAL - BY VESSEL CATEGORY
AVERAGE 1975 - 1983

		HALIFAX	TRENTON	EDMONTON	VICTORIA	NATIONAL
Primary Vessels	Air	2.0	.7	0	6.5	9.2
	Marine	29.0	19.7	.7	41.4	90.8
	Total	31.0	20.4	.7	47.9	100.0
Secondary Vessels	Air	.8	.9	0	2.2	3.9
	Marine	62.0	6.3	.6	27.2	96.1
	Total	62.8	7.2	.6	29.4	100.0
Non-SAR Vessels	Air	.1	.6	-	2.7	3.4
	Marine	27.2	19.7	-	49.7	96.6
	Total	27.3	20.3	-	52.4	100.0
All Vessels	Air	1.0	.6	0	4.0	5.6
	Marine	35.6	16.8	.4	41.6	94.4
	Total	36.6	17.4	.4	45.6	100.0

Source: DND SARSTATS

Victoria and Trenton regions represent 29.4% and 7.2% of the hours expended by secondary vessels but the utilization of these vessels in the Victoria and Trenton regions has decreased dramatically in the last three years.

Hours expended by non-SAR vessels was highest in the Victoria region from 1975 to 1983 at 52.4% of the hours expended by Non-SAR vessels nationally. It is followed by the Halifax region (27.3%) and the Trenton Region (20.3%). The hours expended by non-SAR vessels remained relatively stable in the Trenton region while the Halifax and Victoria regions showed significant increases. Hours expended by non-SAR vessels increased from an average of 63 hrs/year during 1975 to 1980 to 896 hours per year during 1981 to 1983 in the Halifax region. The Victoria region showed an increase from 510 hrs/year to 950 hrs/year during the same time periods.

Tables D7 to D10 of Annex D outline the hours expended by each category of vessel from 1975 to 1983.

Table 2.27 outlines average vessel hours in each category as a percentage of total vessel hours expended on distress incidents. It is interesting to note that Non-SAR vessels expended as many hours on distress incidents from 1975 to 1983 as did primary SAR vessels in the Halifax, Trenton and Victoria regions. Secondary SAR resources represent the smallest

TABLE 2.27

VESSEL HOURS AS A % OF TOTAL VESSEL HOURS
AVERAGE 1975 - 1983

	HALIFAX	TRENTON	EDMONTON	VICTORIA	NATIONAL
Primary Vessels	11.8	7.8	.3	18.2	38.1
Secondary Vessels	13.9	1.6	.1	6.5	22.1
Non-SAR Vessels	10.9	8.0	-	20.9	39.8
Total	36.6	17.4	.4	45.6	100.0

Source: DND SARSTATS

expenditure of vessel hours in all regions except the Halifax region where they are the most frequently used marine resource.

The increase in the number of distress incidents in the Halifax region during the past three years appears to be very significant in terms of resource useage. Table 2.28 outlines the hours expended by each type of vessel as averages from 1975 to 1980 and from 1981 to 1983.

The average number of distress incidents in the Halifax region doubled in 1981 to 1983 while all other regions showed modest decreases in the number of incidents. Primary air resources were utilized in 33% more incidents from 1981 to 1983 in the Halifax region while all other regions showed moderate decreases.

Curiously the hours flown by aircraft in the Halifax region do not reflect the apparent increased activity as the average flying hours expended per year decreased for both primary and secondary aircraft while aircraft hours increased in the Victoria and Edmonton regions.

The greatest reflection of the increased activity during the last three years in the Halifax region is in the hours expended by marine craft. Primary marine craft participated in more than double the amount of distress incidents in 1981 to 1983 than in 1975 to 1980 in the Halifax region and the hours expended by

TABLE 2.28

AVERAGE MARINE CRAFT USEAGE

	HALIFAX		TRENTON		EDMONTON		VICTORIA		NATIONAL	
	75-80	81-83	75-80	81-83	75-80	81-83	75-80	81-83	75-80	81-83
Primary Marine Used Inc/Year	21.0	53.0	60.6	58.0	.8	1.3	123.8	130.6	206.2	242.9
Hrs/Year All Vessels	764.0	1920.5	593.4	456.3	8.9	20.6	1379.6	1541.2	2745.9	3938.6
Hrs/Year Primary Vessels	282.8	547.8	263.3	204.1	8.5	7.3	582.6	552.8	1137.2	1312.0
Hrs/Year Secondary Vessels	417.8	476.4	63.7	23.6	.4	11.7	287.5	39.8	769.4	551.5
Hrs/Year Non-SAR Vessels	63.5	896.3	266.4	228.6	0.0	1.6	509.5	948.5	839.4	2075.0

Source: DND SARSTATS

these craft doubled. The hours expended by secondary SAR vessels in the Halifax region showed a moderate increase while the hours expended by non-SAR vessels increased 14 fold. Overall vessel hours in the Halifax region increased by 150% to 1920 hours per year, the highest of all SAR regions.

In order to assess the deployment of resources the location of distress incidents must be determined. Since marine distress incidents constitute the majority of the incidents and require a more immediate response, air distress incidents will not be considered.

Each Search and Rescue Region is divided into subareas. The DND SARSTATS contain records of the number of distress incidents which have occurred in each subarea. The numbers of marine distress incidents which have occurred from 1975 to 1983 in each subarea of the Halifax, Trenton and Victoria SRR's are summarized in Tables D11 to D13 of Annex D.

Figures 2.8 to 2.11 illustrate the subareas within each region and the average number of marine distress incidents which have occurred in each subarea.

The unrefuelled radius of action for the Buffalo aircraft (500nm) is shown for each region and the unrefuelled radius of action for the SARCUP helicopter (225nm) is shown for the Victoria and Halifax regions. The low concentration of refuelling

sites in the Victoria and Halifax SRR's dictates that in most cases the helicopters cannot effect a rescue more than 225nm from their base without first refuelling.

The Twin Huey helicopters stationed in the Trenton region have an unrefuelled radius of action of less than 225 nm but the Trenton area has a high concentration of possible landing sites following a rescue. A helicopter out of Trenton could therefore fly out in excess of 225 nm, and conduct a rescue and then land at another location to refuel. Therefore the radius of action for the Twin Huey is not shown on Figure 2.10.

The figures show that the present deployment of Buffalo aircraft in each region enables these aircraft to reach most of the region without refuelling and that the majority of the incidents are within the range of the aircraft.

The deployment of helicopters, however, does not represent the same degree of coverage. In the Victoria region all of subarea 306 (the Prince Rupert area) and most of subarea 308 is beyond the unrefuelled radius of action of the SARCUP helicopters in COMOX. An average of 24 marine distress incidents per year occurs in subarea 306.

In the Trenton region subareas 100 and 101 in the western part of the region and subarea 141 in the eastern part are

MARINE DISTRESS INCIDENTS - HALIFAX SRR
Figure 2.8

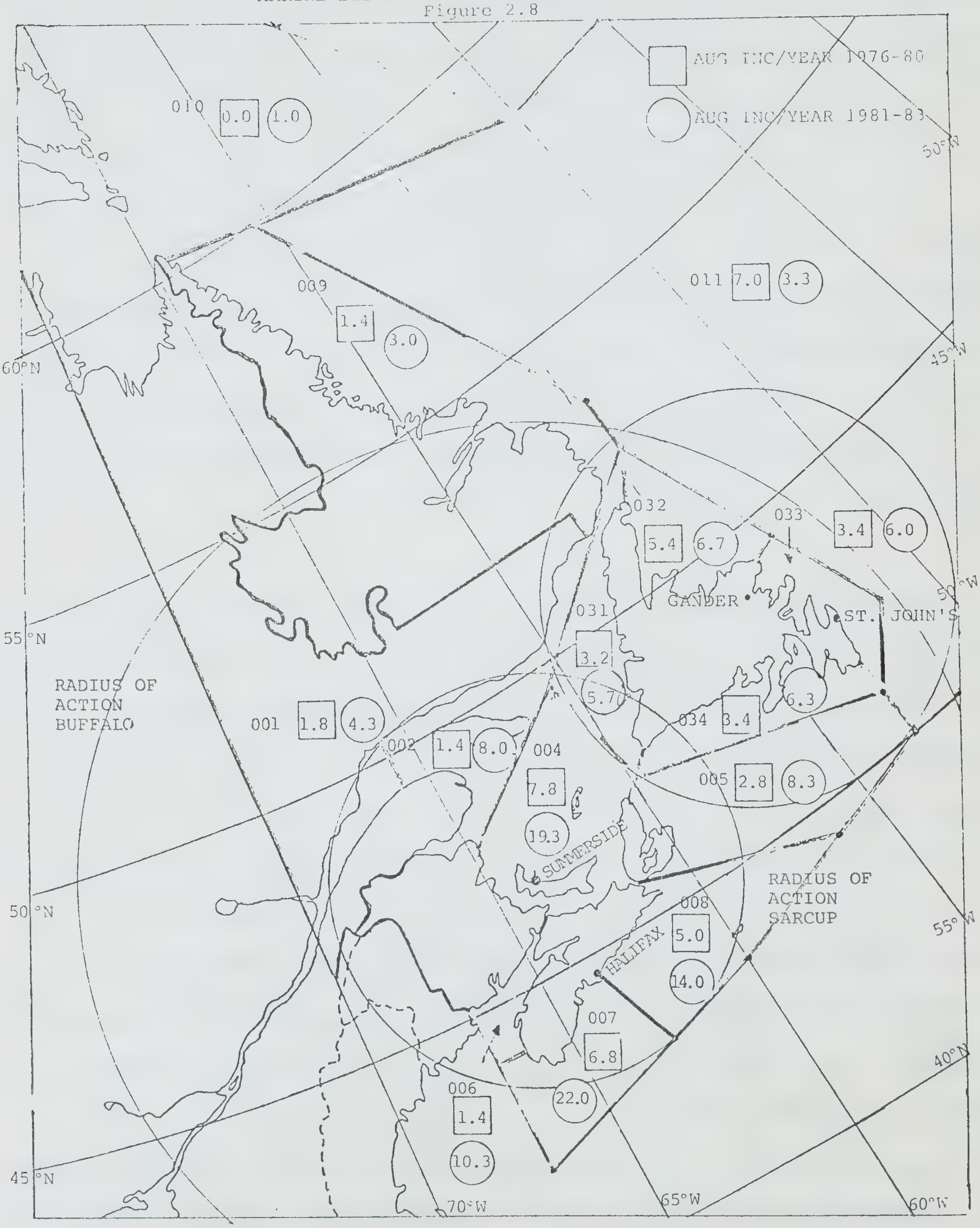
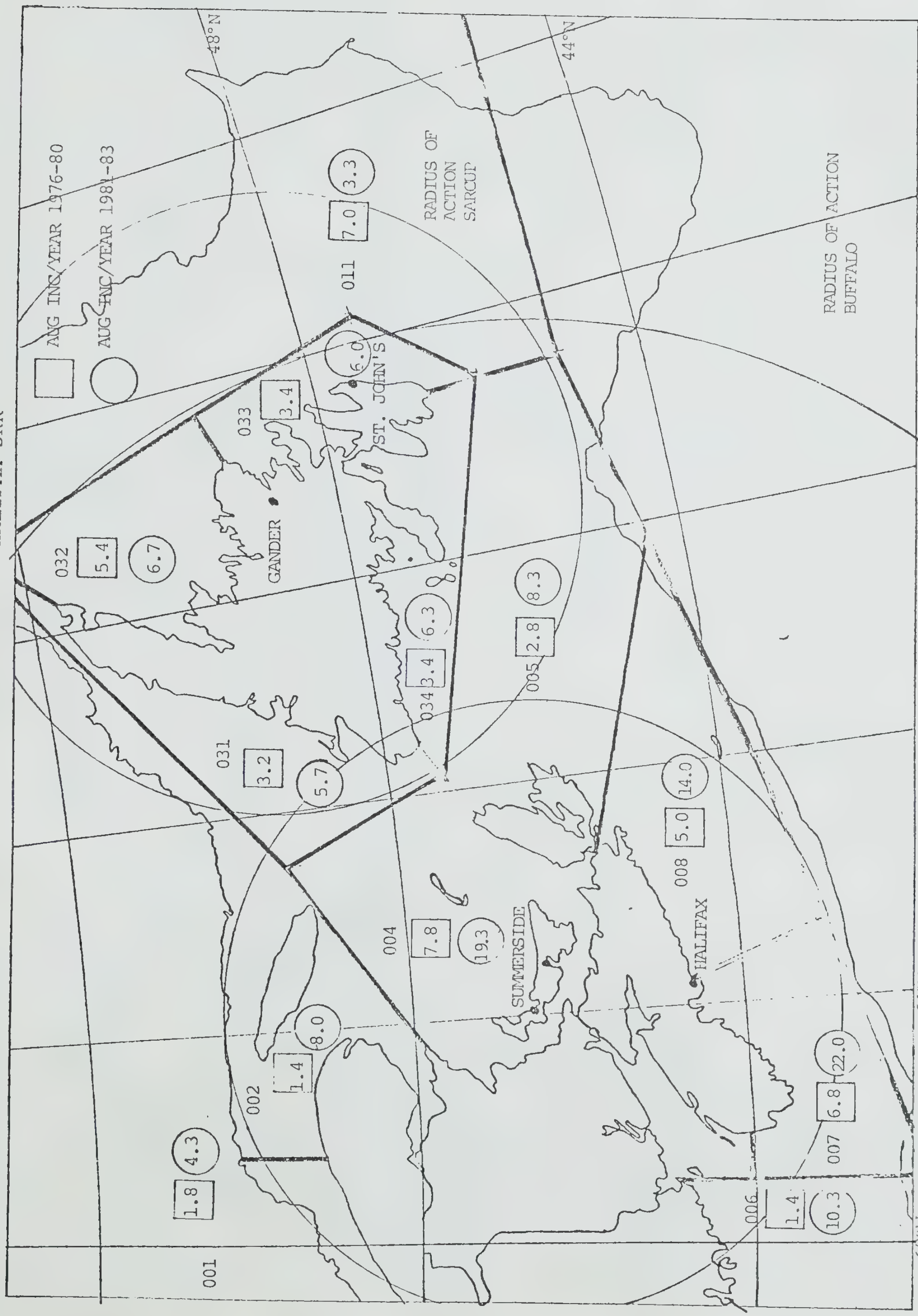
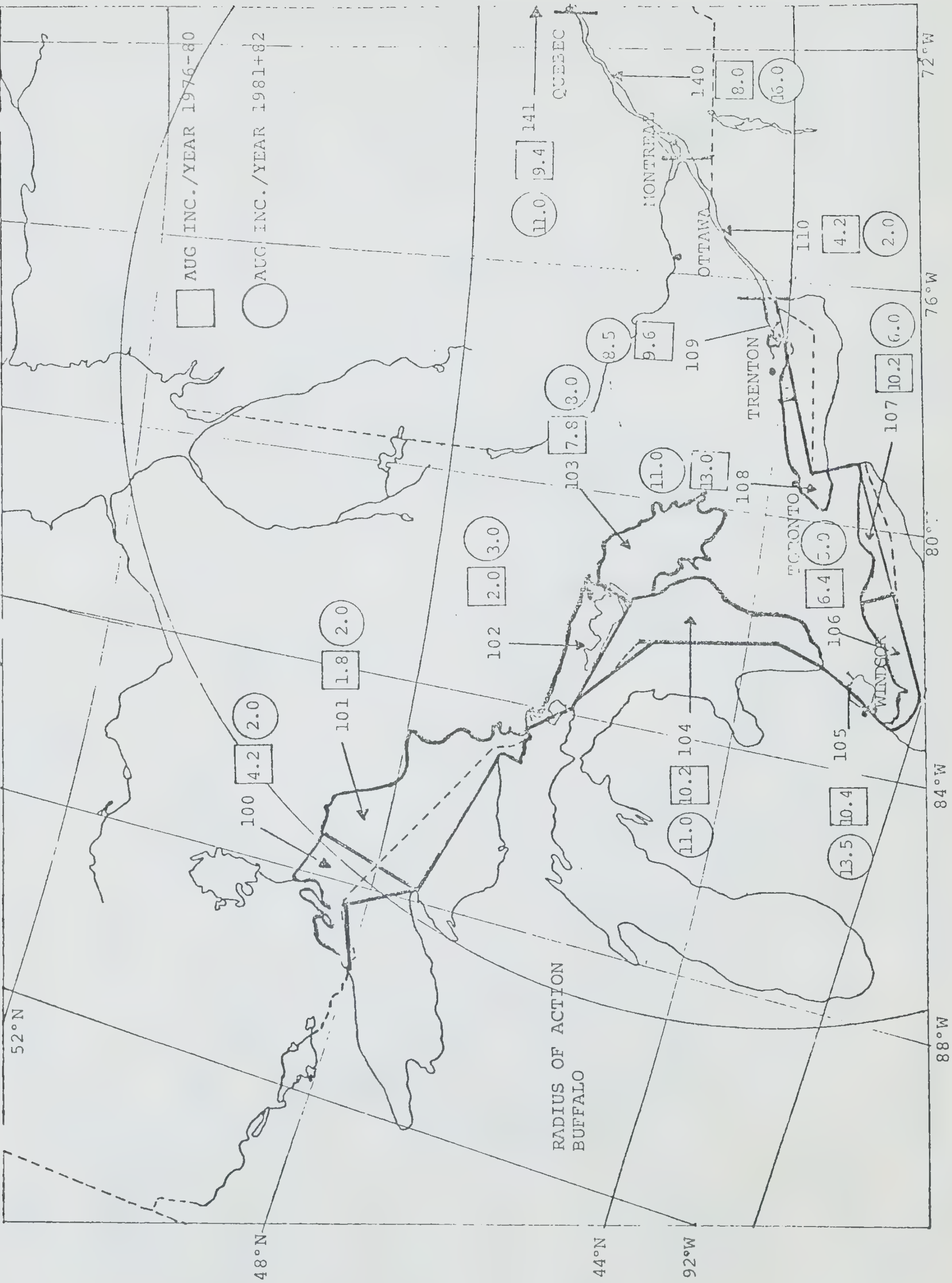


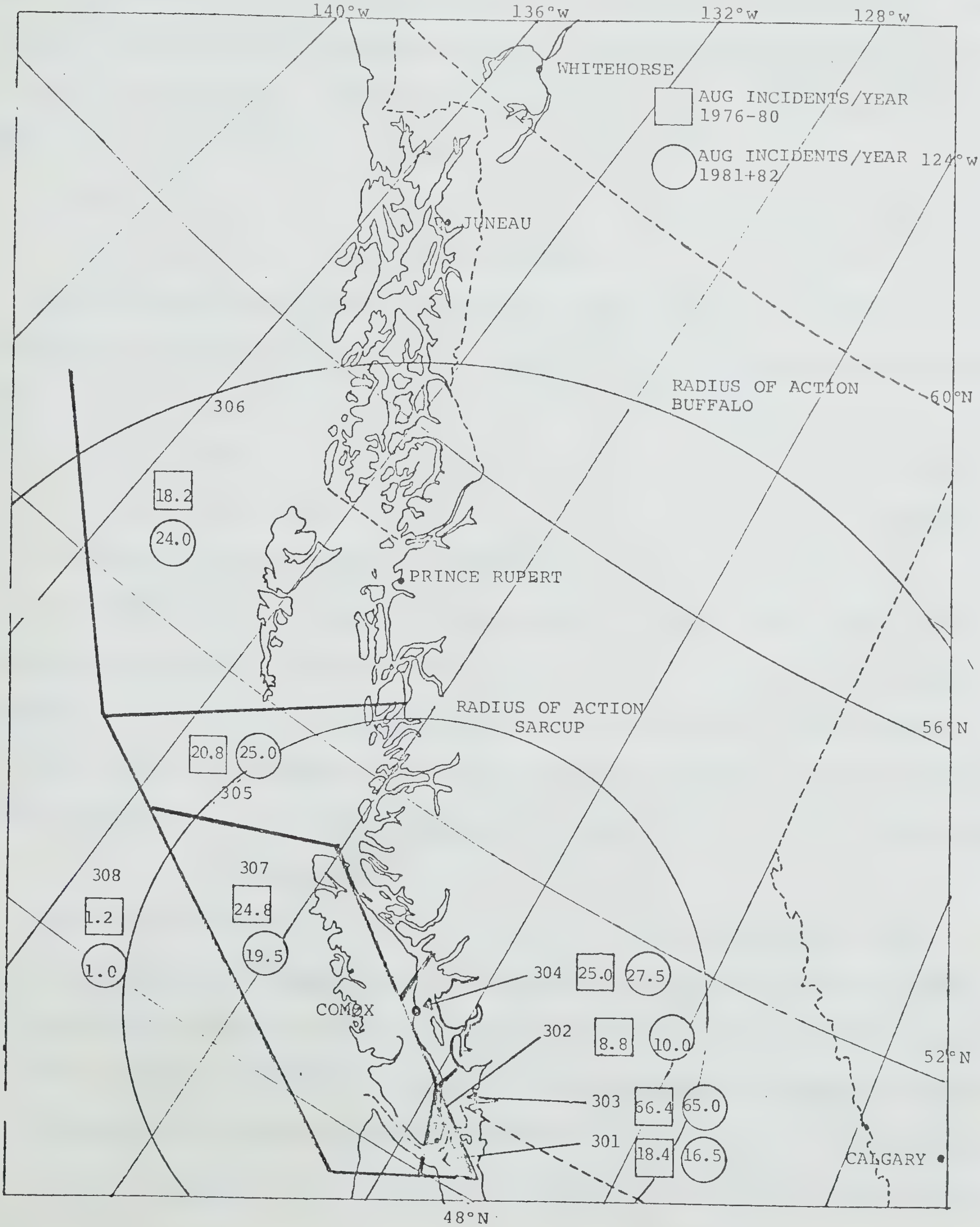
Figure 2.9
MARINE DISTRESS INCIDENTS - HALIFAX SRR



MARINE DISTRESS INCIDENTS TRENTON SRR
Figure 2.10



MARINE DISTRESS INCIDENTS - VICTORIA SRR Figure 2.11



probably out of range of the Twin Huey's. Subareas 100 and 101 average 4 incidents per year while subarea 141 averages 11 per year. However the incidents in subarea 141 are all on the St. Lawrence River and therefore are very close to land. Thus a quick reaction by marine vessels is possible.

The Halifax region is the only region with two bases for SARCUP helicopters. All of subareas 009 and 010 and most of subarea 011 are beyond the unrefuelled radius of action of the SARCUP helicopters. Approximately 7 incidents per year occur in these three subareas.

Analysis

The utilization of SAR resources varies from region to region. Air resources in the Victoria, Edmonton and Trenton regions are utilized almost exclusively for the resolution of air incidents. Due to the terrain in the Victoria region and the long distances in the Edmonton region a large number of flying hours are spent on these incidents particularly in the search phase.

Air resources in the Halifax region are utilized more in marine incidents than in air incidents. Flying hours expended for marine incidents during 1981 to 1983 in the Halifax region were three times that expended for air incidents. Since the probability of survival following a marine incident decreases dramatically with time, large air searches are typically not

carried out following marine incidents as is done following air incidents. In any case searches for marine craft or survivors of marine incidents are discontinued much sooner than searches for survivors from downed aircraft. These factors account, in part, for the larger number of flying hours in the Victoria and Edmonton regions relative to the hours flown in the Halifax region.

As was noted earlier, primary aircraft in the Halifax region responded to more cases per year from 1981 to 1983 than in any other region, with the largest proportion of these being marine distress incidents. The reduced expectancy of survival following a marine incident dictates that the response to these incidents be more immediate than for an air incident. This required response time, when coupled with the long coastline in the Halifax region justifies the existence of two bases for primary rotary wing aircraft in the Halifax region. If the helicopters were removed from one of these bases a large number of incidents would be beyond the unrefuelled radius of action of the remaining helicopters. The extremely limited capabilities of fixed-wing aircraft to effect a rescue of survivors from a marine incident does not justify the placement of fixed-wing aircraft at each of these bases, but the present deployment of helicopters, because of their ability to rescue persons from a vessel at sea, appears to be in keeping with the requirements.

The deployment of three helicopters at each of the bases in the Halifax region is based upon an operational requirement. The Department of National Defence maintains, that in order to ensure the availability of one helicopter on a 24-hour a day basis, three helicopters must be stationed at each base. Thus in order to maintain two operational bases for helicopters in the Halifax region a total of six aircraft is required.

Although aircraft play a large role in marine incidents in the Halifax region, the majority of the marine distress incidents in all regions, including the Halifax region, are resolved using marine resources. A high proportion of the marine incidents occur close to shore where SAR vessels are particularly effective rescue vehicles. The presence of primary SAR vessels and of a high concentration of non-SAR vessels reduces the need to deploy air resources for marine distress incidents. The large number of incidents in the Victoria region in which primary marine resources are used is evidence to this.

In summary the deployment of primary air resources in the Halifax region appears to represent a level of service which is at least equal to that provided in the Trenton region and exceeds that provided in the Victoria region.

Regional Deployment - Halifax SRR

As was stated earlier, it is unlikely that SAR marine resources will be a factor in the rescue of survivors following an incident involving the offshore oil and gas industry . Therefore only the deployment of SAR air resources will be considered in this discussion.

The discussion of SAR client population noted that the offshore industry represents only a small proportion of the total SAR clientele in the Halifax region. However the deployment of SAR resources must provide the optimum service to all SAR clients.

SAR marine resources are generally deployed to provide rescue services within a local area. SAR air resources on the other hand must provide a more regional capability in order to supplement local marine resources or to provide services beyond the range of the marine resources. Therefore in considering the deployment of air resources the occurrance of all distress incidents is considered irrespective of the location of marine resources.

As was stated in the previous section the large area of the Halifax region justifies two bases for helicopters in the region but only one base for fixed wing aircraft. The Halifax Search and Rescue region has several locations where aircraft could be

located. The locations include:

Chatham, New Brunswick

Seven Islands, Quebec

Summerside, Prince Edward Island

Sydney, Nova Scotia

Shearwater, Nova Scotia

Greenwood, Nova Scotia

Stephenville, Newfoundland

Gander, Newfoundland

St. John's, Newfoundland

Goose Bay, Labrador

Proximity to Distress Incidents

In considering the deployment of air resources in the Halifax region the proximity to concentrations of distress incidents is extremely important.

The CC115 Buffalo aircraft has a operating radius of action of 500 nautical miles with one hour on station, while the CH113 SARCUP helicopter has a radius of action of 225 nautical miles with 30 minutes on station without need to refuel. These ranges are maximum planning radii of action for these aircraft and represent approximately 2½ hours flying time for the Buffalo and 2 hours for the SARCUP.

Figures D-1 to D-9 in Annenx D show the radius of action for the CC115 Buffalo for various locations in the Halifax SRR. The optimum locations for these aircraft in terms of proximity to concentrations of distress incidents are ranked along with the basis for this ranking in Table 2.29.

CC115 Buffalo aircraft located in Stephenville would provide the best overall coverage for the Halifax SRR with Sydney being the next best location. The present location of the Buffalo aircraft in Summerside provides coverage for the majority of the incidents which have occurred in the region, but the aircraft must be refulled in order to reach the Labrador coast or the Grand Banks.

Figures D-10 to D-18 of Annex D show the unrefuelled radius of action of the SARCUP helicopters for various locations in the Halifax region. These figures illustrate that if helicopters were based in only one location in the region large concentrations of distress incidents would be beyond the unrefuelled range of the helicopters irrespective of where they were located.

In considering the deployment of helicopters two operational bases must be considered; one in the eastern part of the region (east of 60°W) and one in the western part of the region. Based upon proximity to concentrations of distress incidents the ranking of the locations is as follows:

TABLE 2.29

RANKING OF LOCATIONS FOR BUFFALO AIRCRAFT

RANKING	LOCATION	AREAS NOT COVERED
1	Stephenville	
2	Sydney	Northern part of SRR
3	Summerside	Grand Banks
4	Shearwater	Eastern and northern Nfld. offshore, northern part of the region, Grand Banks
5	Chatham	Avalon Peninsula, Grand Banks
6	Seven Islands	Avalon Peninsula, Grand Banks
7	Greenwood	Eastern and northern Nfld., Grand Banks
8	Gander	Southern Nova Scotia
9	St. John's	Southern Nova Scotia
10	Goose Bay	Southern part of the region

WEST		EAST	
1.	Summerside	1.	Gander
2.	Chatham	2.	Stephenville
3.	Shearwater	3.	St. John's
4.	Greenwood	4.	Goose Bay
5.	Sydney		
6.	Seven Islands		

Figures D-19 to D-28 of Annex D illustrate the unrefuelled radius of action of the SARCUP helicopters for various east/west bases. Based upon proximity to concentrations of distress incidents the relative ranking of locations is as follows:

1. Summerside and Gander
2. Chatham and Gander
3. Greenwood and Stephenville
4. Summerside and St. John's
5. Shearwater and Gander
6. Greenwood and Gander
7. Chatham and St. John's
8. Shearwater and St. John's
9. Greenwood and St. John's
10. Seven Islands and St. John's

In terms of providing the closest proximity to historical concentrations of distress incidents the present location of the

helicopters in Summerside and Gander provides the optimum locations. However, the present locations for the helicopters result in rigs on the Scotian Shelf and the Grand Banks being beyond their unrefuelled range. In the western part of the region the only location from which SARCUP helicopters can reach the drilling rigs without refuelling is Shearwater. Transferring the helicopter base from Summerside to Shearwater would result in the St. Lawrence River and the northern part of the Gulf of St. Lawrence being beyond the unrefuelled range. Similiarily in the eastern part of the region, St. John's provides the only location from which helicopters can easily reach the drilling rigs on the Grand Banks with refuelling. Transferring the helicopters from Gander to St. John's would result in the west and north coasts of Newfoundland being beyond their unrefuelled range.

Weather/Operating Limitations

Due to the nature of Search and Rescue Operations, it is essential that SAR aircraft fly from airfields with the best weather and air navigation aids. Therefore airport availability for Search and Rescue response depends on the following from the weather/operating point of view:

a. weather records,

b. navigation aids for launch and recovery,

c. terrain limiting factors.

For airports in Atlantic Canada, Atmospheric Environmental Service data obtained through National Defence Headquarters Directorate of Meteorology and Oceanography for the period 1952-72 is summarized in Tables 2.30 to 2.32 for the most commonly used SAR airports in the region. The figures given are the percentage of the total hours in a month that the airport is below the specified limits. The minimums given are in terms of height in feet and distances in miles.

Weather has been included for Argentia as it was once a U.S.N. Air Station. The airport has no landing aids and has been closed for over 10 years.

Using weather limitations alone, on a yearly average basis the order of preference of airports in terms of their availability is:

Preference	Fixed Wing	Rotary
1	Goose Bay	Goose Bay
2	Stephenville	Stephenville/Greenwood
3	Greenwood	Chatham
4	Summerside	Summerside
5	Chatham	Seven Islands
6	Seven Islands	Sydney
7	Shearwater	Gander
8	Sydney	Shearwater
9	Gander	St. John's
10	St. John's	

TABLE 2.30
FREQUENCY OF AIRFIELD WEATHER
CEILING BELOW 100 FEET AND VISIBILITY
LESS THAN 1/4 MILE
% OF TOTAL MONTHLY HOURS

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVERAGE
Seven Islands	1.0	1.3	1.1	0.1	0.8	1.5	2.4	2.1	1.8	1.4	1.2	0.9	1.3
Greenwood	1.2	0.6	0.7	0.4	0.3	0.6	0.8	0.8	1.1	1.3	0.9	1.1	.8
Chatham, N.B.	0.6	0.9	1.0	0.7	0.3	0.8	0.6	0.3	0.8	0.9	0.8	0.7	.7
Summerside	1.7	2.0	1.7	1.2	0.6	0.5	0.3	0.2	0.4	0.5	0.8	1.3	.9
Stephenville	1.2	1.3	0.4	0.4	0.4	1.2	1.0	0.4	0.3	0.4	0.1	0.8	.7
Gander	2.1	2.6	2.1	2.1	2.4	2.1	1.2	1.0	0.9	1.1	2.1	1.0	1.7
St. John', Nfld.	5.5	5.8	7.7	9.1	10.4	6.8	6.0	3.8	3.0	3.6	4.2	2.6	5.7
Shearwater	1.7	1.8	2.5	1.9	4.0	6.3	6.6	3.8	1.8	2.2	1.8	1.2	3.0
Goose Bay	0.2	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.1	.2
Sydney	1.3	2.2	2.5	3.3	3.3	3.2	2.5	0.9	1.2	1.1	1.3	1.4	2.0
Note:													
Argentia	1.1	1.4	1.2	1.8	3.5	7.0	8.2	5.0	3.2	2.4	1.4	1.1	

Source: National Defence HQ, Directorate of Meteorology and Oceanography

TABLE 2.31
FREQUENCY OF AIRFIELD WEATHER
BELOW SEARCH AND RESCUE MINIMUM
FIXED WING VFR CLEARANCE
% OF TOTAL MONTHLY HOURS
(Below 700' Ceiling and/or One Mile Visibility)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVERAGE
Seven Islands	9.7	10.2	10.2	8.2	10.1	12.7	15.2	11.2	10.6	10.3	14.1	9.7	10.2
Greenwood	9.7	8.4	7.3	6.3	5.0	5.1	7.3	6.7	6.3	7.7	7.6	8.4	6.6
Chatham, N.B.	11.2	10.7	12.1	11.0	10.9	10.0	7.3	6.3	7.9	9.2	14.6	12.2	9.5
Summerside	13.6	11.2	13.7	14.3	11.0	9.3	7.3	5.5	5.7	7.4	10.8	10.8	9.3
Stephenville	8.0	8.8	6.1	6.8	7.5	9.2	9.5	6.0	2.2	4.1	4.0	6.7	6.2
Gander	22.4	21.6	24.7	28.3	24.6	20.8	14.7	15.3	12.4	17.2	22.9	19.4	18.8
St. John', Nfld.	27.6	29.5	33.4	37.3	37.0	33.1	31.3	27.3	22.9	24.0	29.8	23.4	27.5
Shearwater	15.4	15.0	15.8	17.8	23.8	27.4	29.7	24.0	15.3	14.0	17.6	13.4	17.7
Goose Bay	5.1	4.6	5.9	5.8	5.1	4.0	4.2	2.9	2.8	4.5	6.3	4.8	4.3
Sydney	17.6	17.4	20.6	22.0	24.8	25.3	23.0	13.7	11.1	13.0	17.8	14.4	18.4

Source: National Defence HQ, Directorate of Meteorology and Oceanography

TABLE 2.32
FREQUENCY OF AIRFIELD WEATHER
CEILING BELOW 200 FEET AND VISIBILITY
LESS THAN ½ MILE
% OF TOTAL MONTHLY HOURS
(Takeoff Limit for CH113 SARCUP)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVERAGE
Seven Islands	2.4	2.7	3.0	1.7	1.9	3.1	4.4	3.8	3.2	2.6	3.0	2.5	2.9
Greenwood	2.4	1.9	1.5	0.8	0.6	0.9	1.5	1.5	1.7	2.1	1.5	2.2	1.6
Chatham, N.B.	2.1	2.4	2.8	2.0	1.1	1.6	1.3	0.9	1.6	1.9	2.9	2.8	2.0
Summerside	3.1	3.7	4.1	3.1	1.5	1.2	0.7	0.5	0.9	1.2	2.1	2.8	2.1
Stephenville	2.7	2.9	1.4	1.0	1.0	2.0	2.0	0.8	0.6	0.7	1.8	1.9	1.6
Gander	5.4	5.9	6.0	5.5	5.7	4.7	2.9	2.6	2.0	2.8	4.6	3.3	4.3
St. John', Nfld.	9.7	10.5	12.5	14.8	16.3	11.7	10.1	7.0	5.4	6.3	8.2	6.1	9.9
Shearwater	3.3	4.3	3.0	4.8	8.9	12.3	13.5	8.8	4.1	4.7	4.7	3.2	6.3
Goose Bay	0.7	1.0	1.0	0.7	0.6	0.3	0.3	0.3	0.3	0.7	1.0	0.7	.6
Sydney	3.6	4.5	4.9	5.6	6.2	6.2	5.3	2.2	2.2	2.3	3.4	2.8	4.1
Note:													
Argentia	2.7	3.0	3.3	3.9	6.7	13.0	15.6	10.1	6.3	4.3	2.7	2.4	6.2

Source: National Defence HQ, Directorate of Meteorology and Oceanography

Support Infastructure

In order to support search and rescue aircraft over a long period the following are required:

(1) hangers for aircraft,

(2) office and accommodation for 25 aircrew (50 where fixed or rotary wing aircraft are co-located),

(3) office and workspace for about 60 (or 120) maintenance personnel,

(4) storage for spares and ground handling equipment,

(5) supply, accounting, administrative, engineering support,

(6) living accommodations

(7) transportation support for replacement of fuel, parts and other stores.

For economics of scale it is apparant these facilities are best provided at a multi-tasked military airport. Based on the most useful items being available the following is the ranking the best possible locations for a Search and Rescue Base:[23]

(1) Summerside

(2) Greenwood

(3) Shearwater

(4) Chatham

(5) Gander

(6) Goose Bay

(7) St. John's

(8) Sydney

(9) Stephenville

(10) Seven Islands

Obviously the best possible location for aircraft in terms of support infastructure is an existing base as the required infastructure has been put in place. Consequently Summerside appears to be the best location in the western part of the region and Gander in the eastern part.

Alternate Sources of Search and Rescue Support

The presence of alternate sources of search and rescue support can affect the deployment of primary resources. The Halifax region has two major sources of support; the Canadian Marine Rescue Auxiliary (CMRA) and the squadron of Sea King helicopters based at Shearwater, N.S. which are designated as secondary SAR resources.

The presence of the CMRA provides a local rescue service but does not alleviate the need to provide helicopter coverage for these regions and as such does not affect the helicopter deployment.

The squadron of Sea Kings at Shearwater, however provide for

a rescue resource which can be utilized to cover much of the area covered by the helicopters at Summerside. These helicopters as with the aircraft at Summerside must refuel in order to reach the drilling rigs on the outer part of the Scotian Shelf (Figure D-29, Annex D).

Analysis

Table 2.33 outlines the rankings of the possible locations for fixed wing and rotary wing helicopters by the three criteria discussed.

The current deployment of fixed wing aircraft in Summerside appears to be largely justified on the basis of the existance of an infastructure to support the operation. Stephenville offers a better proximity to the majority of the distress incidents and marginally better weather (below 700' and one mile, 6.2% of the year as compared to 9.3% of the year for Summerside).

The current deployment of rotary wing aircraft in Summerside and Gander is justified by their proximity to distress incidents and the infastructure which is in place. Greenwood offers better weather than Summerside in the western part of the sector but the improvement in weather represents only ½% of the total time or approximately two days more per year that helicopters can fly. Summerside, therefore, appears to be the optimum location for helicopters in the western part of the Halifax region.

TABLE 2.33

RANKING OF LOCATIONS FOR AIRCRAFT

FIXED WING RANKING

	Proximity	Weather	Infastructure
Stephenville	1	2	9
Sydney	2	8	8
Summerside	3	4	1
Shearwater	4	7	3
Chatham	5	5	4
Seven Islands	6	6	10
Greenwood	7	3	2
Gander	8	9	5
St. John's	9	10	7
Goose Bay	10	1	6

ROTARY WING RANKING

	Proximity		Weather		Infastructure	
	West	East	West	East	West	East
Summerside	1			2	1	
Chatham	2			3	4	
Shearwater	3			5	3	
Greenwood	4			1	2	
Sydney	5			6	5	
Seven Islands	6			4	6	
Gander		1		3		1
Stephenville		2		2		4
St. John's		3		4		3
Goose Bay		4		1		2

In the eastern part of the region Gander represents the best location in terms of proximity to incidents and support infastructure. Goose Bay and Stephenville offer better weather conditions but the poor proximity to distress incidents makes Goose Bay a poor overall location. Stephenville weather would allow helicopter operations an additional 2.7% of the time or about ten days per year more than in Gander but when coupled with the radius of action for helicopters from Summerville, Stephenville does not represent an effective overall deployment of helicopters.

Gander is therefore the optimum location for helicopters in the eastern part of the region.

The choice of Summerside and Gander as the optimum locations for helicopters in the region also affects the decision as to the location of fixed wing aircraft. The current location of the fixed wing aircraft at Summerside represents an economy of scale. Relocation of the fixed wing aircraft to Stephenville is probably not justified based upon the marginally better weather and somewhat increased proximity to distress incidents.

2.7 TRAINING OF SAR PERSONNEL

2.7.1 Air Personnel

Four Canadian Forces (CF) classifications/trades are employed in SAR flight operations; these are Pilot, Navigator, Flight Engineer and SAR Technician. Navigators are employed in fixed wing aircraft, but not usually in helicopters. Since their profile is not unlike that of pilots, it will not be detailed. With the exception of the SAR TECH, who is employed on SAR duties throughout his career, the other three air crew categories may have come from and may be subsequently posted to units with different military (non-SAR) missions.

Pilot - Rotary Wing SAR (2 per aircraft)

Pilots of SAR helicopters must be trained military pilots (officers) with a rotary wing speciality. The CF require that 60% or more of SAR unit pilots be aircraft commanders (AC). This leads to a practical maximum of approximately three first tour pilots per unit. On SARCUP helicopter equipped units, specialist training for the SARCUP aircraft is conducted at the unit level as there are insufficient SARCUP aircraft in the system to centralize training at one location. Training for the SARCUP helicopter requires 35 training days, which may translate into six months during the posting season (summer) because aircraft are being used for operations.

Following training, a pilot immediately becomes productive as a SAR pilot and enters the phase of upgrading to aircraft commander. For an experienced pilot (2nd tour or better) the process takes approximately one year. For a first tour pilot upgrading may take up to three years. Subsequently all pilots undergo continuation training with monthly requirements and regular proficiency checks.

Flight Engineer - Rotary Wing SAR

One flight engineer is employed per aircraft, except at the Comox, B.C. squadron which uses two per aircraft. Each flight engineer must be qualified on the basic Flight Engineer's (FE) course at CFB Trenton, Ontario (non-commissioned officer). This is followed by a period of on-the-job training and ground study of approximately 60 days. During this time the individual is qualified as a restricted flight engineer and always flies with a senior flight engineer. Upon completion of the on-the-job training and upon attaining an approved level of performance, he becomes a qualified FE. Flight engineers subsequently undergo continuation training with monthly requirements and regular proficiency checks.

Search and Rescue Technician (SAR TECH) - Two per aircraft

The method of becoming a SAR TECH is unique in the CF trade system. The trade may only be entered by re-muster from one of the other CF trades. The candidate must be male, corporal or

above, with a minimum trade qualification level of five, and have two years prior CF service. Competition to enter the trade is extremely keen; in a number of cases, applicants have accepted a demotion from Sargeant to become eligible. Physical requirements are also high, even by military standards.

Successful applicants are sent on a Preselection Course of 35 training days which consists of two phases:

- Phase I - CF Survival Training School, Edmonton
- Phase II - CF Fleet Diving School

The preselection course is followed by a SAR TECH course of 120 training days which is held at CFSTS, Edmonton, CFSTS Detachment, Jarvis Lake (Land Survival), CFSTS Detachment, CFB Comox (Sea Survival). On arrival at a SAR Unit, the new graduate works with a senior SAR TECH on all missions for 21 months as a restricted SAR TECH. After demonstrating the required capabilities, he is declared operational on both fixed and rotary wing SAR aircraft. Once operational the SAR TECH undergoes continuation training with monthly requirements and regular proficiency checks. After a minimum of two years operational employment, on the recommendation of his commanding officer, he may be selected for the 15 day SAR Team Leader course at CFSTS, Edmonton.

The SAR TECH is trained in survival techniques (summer bush, winter bush, arctic and sea), medical treatment of survivors

(advanced first aid level), mountain climbing, water techniques, parachuting into an accident scene and helicopter hoist/rappelling.

2.7.2 Marine Personnel

The ships company of the Jackman and Grenfell are 16 in number and the Alert and Daring, 35 and 27 respectively. The Captain and the officers of these ships are experienced seamen. The Captain will have a Home Trade ON1 certificate which will take a minimum of 10 years sea time to acquire. The mate will have a similar qualification. Some of the masters and mates have taken the National Marine SAR course at the Transport Canada Training Institution.

The crews of these ships will have served in them on an average of 8 years. The training of these men is in accordance with the Canada Shipping Act, and all officers and some of the crew have taken the Marine Emergency Duties course (MED II) which includes some training on search and rescue. There is no additional formal training given in rescue work by the Coast Guard. Drills and practical shipboard exercises are held at the discretion of the Commanding Officer and are not monitored by CCG Headquarters.

In Newfoundland training has been arranged between the Captains of the Jackman and Grenfell and the Commanding Officer of the 103 Search and Rescue Unit in Gander. This is a local arrangement and not a requirement by the Coast Guard for their SAR ships.

2.7.3 RCC Personnel

Marine Controller

Marine Controllers in RCCs are Canadian Coast Guard personnel. A CCG Watch-Keeping Certificate of Competency is required for the position. This certificate is the equivalent of the merchant WKM, Watchkeeping Mate Certificate of Competency having validity as a Third Mate foreign-going or a Second Mate home-trade.

In order to qualify for this Certificate the individual must have completed the MED II course and have at least two years sea service. A large proportion of the sea service must be served on deck and must be in a trading ship in excess of 200 tons although service on ferries, fishing craft or pleasure yachts in excess of 25 tons is acceptable.

The statement of qualifications for a marine controller states that the individual should have practical shipboard experience in assisting in the conduct and coordination of Search and Rescue operations.

The requirement for a Watch-Keeping Certificate represents a reduction in qualifications for Marine Controllers. When RCCs were first jointly manned in 1961, CCG representatives held master mariners certificates which represented a much higher level of training and much more lengthy sea service.

Upon entering the RCC Marine Controllers are sent to the National SAR Course at the Transport Canada Training Institution and go through a period of on-the-job training prior to becoming a fully qualified marine controller.

Air Controller

Air Controllers in RCCs are Department of National Defence personnel. In the past Air Controllers were recruited from various trades within the armed forces, but the present practice is to recruit Air Controllers from the aircrew of SAR squadrons. Air controllers therefore must be SAR pilots, or navigators, and will have had experience in conducting Search and Rescue operations.

Upon entering the RCC air controllers are sent to the National SAR Course at the Transport Canada Training Institution and must go through a period of on-the-job training prior to becoming fully qualified air controllers. Some air controllers are sent to the U.S. Coast Guard SAR School at Governors Island, New York.

Shift Supervisors

Shift supervisors in RCCs are promoted from the position of Air or Marine Controller based upon their performance in that position. In addition to the training received as a Controller the Shift Supervisor attends the Canadian Armed Forces Searchmasters Course in Trenton, Ontario.

2.7.4 Courses

MED II Course

The MED II course is a three-week course which is divided into four segments; Lifesaving Appliances, Firefighting, Survival and Rescue and First Aid.

Lifesaving appliances comprise the first five-day section of the course. Students are given classroom and hands-on instruction in the use and care of lifeboats, the launching of lifeboats and in the handling of lifeboats in the water. Instruction in the storage, launching, inflation, handling, and boarding of inflatable life rafts is also given.

The operation of radio equipment used in life rafts is practised and instruction is given on emergency and abandon ship procedures.

The second section of the course consists of a five-day firefighting course. It is intended to give a practical and

theoretical knowledge of firefighting techniques. The course provides instruction on the use of portable extinguishers, hoses, and breathing apparatus and includes lectures on causes, prevention, types and containment of fires. Trainees are required to participate in extinguishing fires of various types and sizes.

The third section of the course is a two-day course on Survival and Rescue, the intent of which is to give a practical knowledge of survival and rescue techniques. The course covers the following topics:

- the SAR organizations in Canada and the U.S.
- the use of distress signals
- signals and breeches buoy drills
- the use of helicopters and aircraft in SAR operations
- rescue operations involving own ship and survivors from the water, inflatable raft, lifeboat, ditched aircraft
- basic damage control
- effect of wind and sea on lifeboats and liferafts

The fourth section of the course consists of the three-day St. John's Ambulance First Aid Course. A more complete description of this course is included in Annex F.

<u>National Search and Rescue Course</u>

The National Search and Rescue Course is designed to train personnel to perform the duties of Rescue Coordination Centre

and Rescue Sub-Centre watchkeepers and to perform the Search and Rescue functions of CCG ships officers.

The course is divided into main topic areas which have the following requirements which the students must demonstrate:

- Topic 1 - SAR Organization
  - a) Identify the various International organizations and associated publications used in Seach and Rescue.
  - b) Define the role and responsibilities of the Departments of Transport and Defence in relation to Search and Rescue in Canada.

- Topic 2 - SAR Facilities
  - a) Describe the capabilities and limitations of the SAR facilities in Canada including Rescue Coordination Centers (RCC), Rescue Sub-Centers (RSC), and air and marine resources.
  - b) Describe new SAR equipment under development.
  - c) Describe the purpose of the Automated Mutual-Assistance Vessel Rescue System (AMVER) and the types of information available from AMVER.
  - d) Describe the use of an extensive list of manuals in SAR operations.

- Topic 3 - Communications
  - a) Describe the communications capabilities and responsibilities of the various components of the SAR organizations in Canada.
  - b) Describe the communications facilities available to the RCC/RSC.
  - c) Describe the duties of Air Traffic Control as they relate to SAR Operations.
  - d) Demonstrate proper radiotelephone procedures and draft messages to the RCC/RSC in accordance with current policy and procedures.

- Topic 4 - Emergency Care
  - a) Describe the emergency care facilities and considerations involved in Marine SAR.

- Topic 5 - Documentation, SAR Reports and Records
  - a) Describe the various SAR reports and complete the Marine SAR incident form.

- Topic 6 - Awareness and Initial Action Stage
  - a) Describe how to gather information concerning a SAR case, evaluate this information, assign an emergency phase, alert facilities and conduct communications searches in accordance with SAR Orders and Procedures.

- Topic 7 - Planning
  - a) Enumerate the persons involved in Search Planning and define their responsibilities; detail the correct planning sequence and perform the necessary computations to carry out a marine search.
  - b) Initiate, coordinate and terminate an extensive multi-unit (aircraft and vessels) search under varying weather conditions and locations.
  - c) Describe the procedures when affecting a rescue.
  - d) Describe the types of submersible mishaps that may occur and how to effectively deal with these mishaps.

- Topic 8 - Conclusion
  - a) Explain the considerations involved in the conclusion of a SAR case (successful or unsuccessful).
  - b) Explain the applicable sections of the Canada Shipping Act relating to; distress signals, obligations and procedures, appointment and powers of rescue coordinators and salvage rights.
  - c) Explain legal implications of actions taken during SAR incidents.

2.8 GOVERNMENT SAR IN THE NORTH SEA

2.8.1 Introduction

Of the many areas in the world where offshore exploration for oil is taking place the development of the North Sea oil fields by the United Kingdom and Norway is the one area which is comparable to the Canadian development. This section discusses the Search and Rescue facilities available in the North Sea.

Although the North Sea has some similarities to to Canadian offshore exploration there are many differences especially for Search and Rescue. The North Sea oil area is situated between five countries - United Kingdom, Norway, Denmark, W. Germany and the Netherlands (Fig. 2.12). The maximum distance between an air field and an oil field is about 120 nautical miles. For aircraft there are many more alternative airfields in the event of inclement weather.

The North Sea is a very busy body of water. Many ships pass over it daily plying their trade to the many parts of Europe. In addition all nations fish in various areas throughout the North Sea. Each nation provides its own fishery protection service which is generally manned by naval personnel. Thus the vessels of opportunity, both civil and military manned, which would be available to assist in a Search and Rescue operation are far more numerous in the North Sea than off the East Coast of Canada.

OIL AND GAS IN THE NORTH SEA AREA

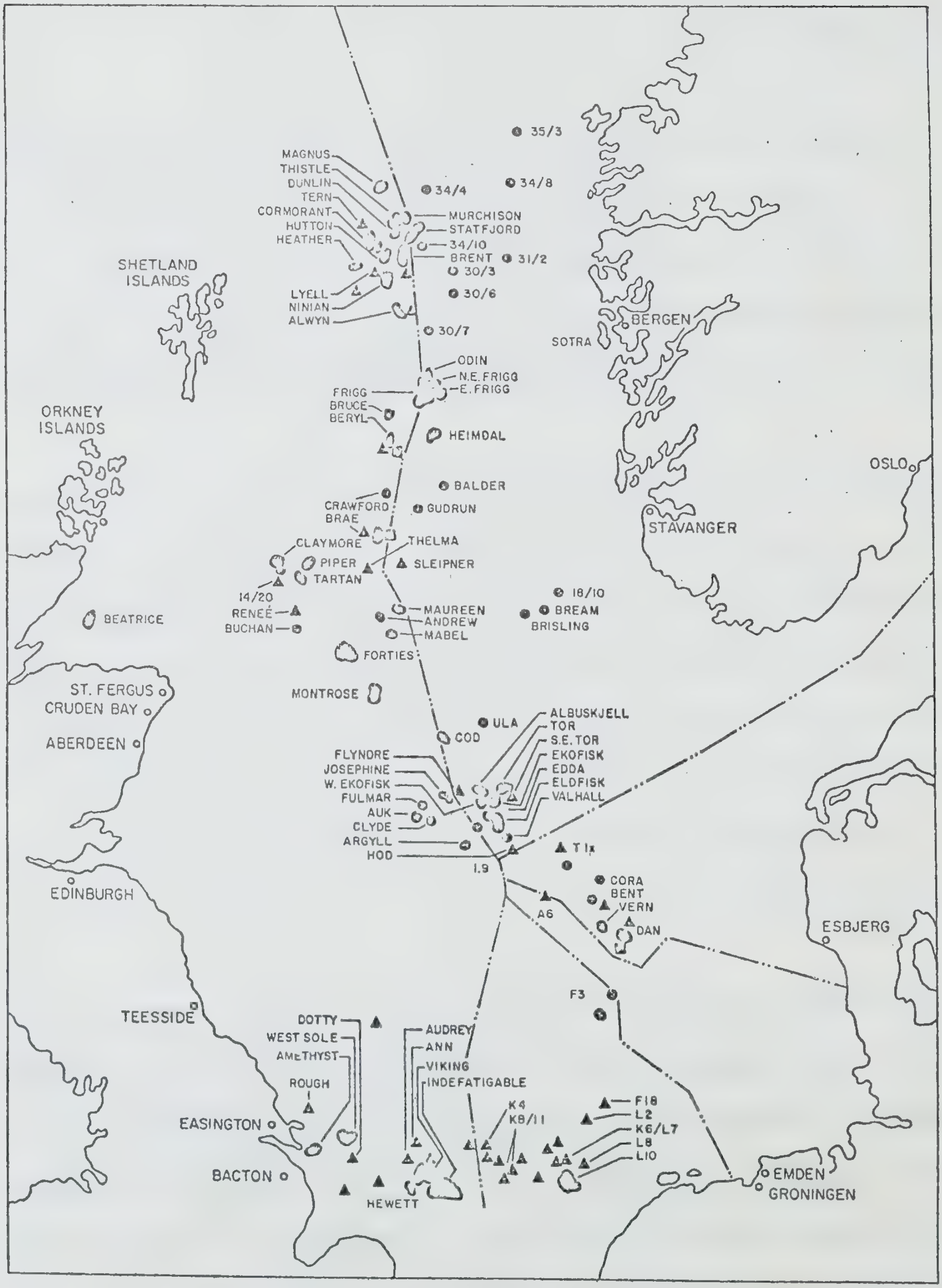


FIGURE 2.12

The North Sea oil fields produce about 1 million barrels of oil per day. The working population in these fields is over 20,000 persons in the British sector and 10,000 persons in the Norwegian sector, which when added to workers in the Danish, German and Dutch sectors brings the total to approximately 40,000.

2.8.2 SAR - United Kingdom

The United Kingdom SAR system is served by three agencies. These are the Royal National Lifeboat Institute, the Armed Forces (Royal Air Force and Royal Navy) and HM Coast Guard. Each agency is independent of the others, although all respond to HM Coast Guard which is the coordinating agency for civil maritime SAR response.

Responsibilities

As with Canada, the United Kingdom is required to provide a maritime search and rescue organization around its coasts under the Convention on the High Seas and the Convention on Safety of Life at Sea (SOLAS). The United Kingdom area of responsibility for SAR measures for ships or persons in distress covers the coasts of the UK and Northern Ireland and extends over an area which corresponds to that laid down by the International Civil Aviation Organization (ICAO) as the area assigned to the UK for aircraft distress. The exception to this are the English Channel where the UK and France have agreed upon a demarkation line for

SAR purposes and for offshore oil and gas emergencies where the internationally agreed demarkation line represents the division of responsibility.

Responsibility for the coordination of SAR operations rests with two agencies. HM Coast Guard, which is part of the Department of Trade, coordinates responses to maritime civil SAR Incidents and the Ministry of Defence coordinates responses to armed forces incidents and civil aircraft incidents.

The Coast Guard is a civilian, uniformed service which is part of the Marine Directorate of the U.K. Department of Transport. The Coast Guard has the following responsibilities:

a. Coordination of all civil marine search and rescue measures for vessels and persons in the U.K. Search and Rescue region;
b. Operation of the Channel Navigation Information Service on behalf of the Department of Transport;
c. Operation of certain countries pollution measures on behalf of the Department of Transport;
d. Miscellaneous offshore duties.

HM Coast Guard is responsible for requesting other appropriate authorities to assist in distress situations and will coordinate all subsequent combined operations until no further help is required.

The Ministry of Defence, operting through RCC's at Edinburgh and Plymouth is responsible for all SAR operations for the armed forces and on behalf of the Department of Transport, for civil aircraft in distress within the U.K. SAR region of responsibility.

The United Kingdom does not provide additional or special SAR equipment or facilities for the North Sea oil industry. It is the opinion of the Government that it is the responsibility of the petroleum companies to provide all the rescue facilities for their personnel and this is written into their leasing contracts.

Organization and Equipment and Deployment

HM Coast Guard, which is primarily a lifesaving service, is responsible for initiating and coordinating all civil maritime search and rescue measures for vessels or persons in need of assistance.

The Coast Guard is organized in six Maritime Search and Rescue regions. (SRR) each of which operates a Maritime Rescue Coordination Centre (MRCC). Each region is subdivided into a number of districts in each of which is a Maritime Rescue Sub Centre (MRSC).

The Coast Guard Organization maintains a constant radio telephone and telex watch at the 25 MRCCs and MRSCs. In addition to the MRCCs and MRSCs there is an organization of auxiliary coast guard watch and rescue stations grouped within sectors at

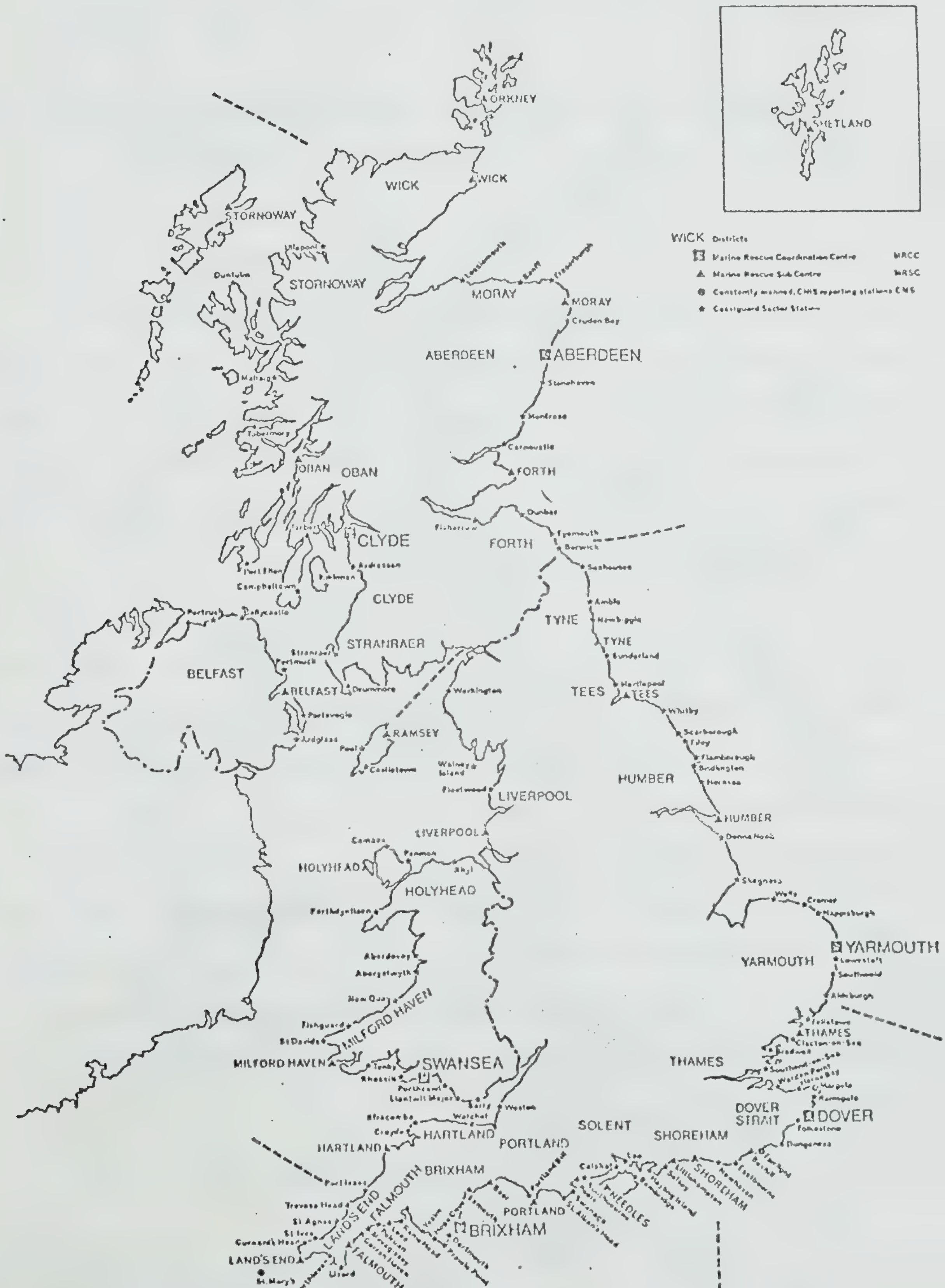
which a watch can be set when required. These auxiliary stations are managed by regular Coast Guard officers and manned by volunteers. There are 113 sectors in each of which is at least one auxiliary Coast Guard station (Fig. 2.13).

In addition to watchkeeping, HM Coast Guard and the auxiliary Coast Guard operate Coast Guard Rescue Companies which man breeches buoy, cliff, and other recue equipment and carry out searches along the coast. There are auxiliary Coast Guards 'afloat' selected from fishermen, ferrymen or yachtsmen who assist in SAR incidents.

HM Coast Guard also administers the Shoreboat Rescue Scheme, which includes some 700 plus boats around the coast which are available for SAR duties. The Scheme includes a number of privately organized and independent rescue services. The Coast Guard insure and reimburse members of the Shoreboat Rescue Scheme for expenses incurred when they are called out.

HM Coast Guard also has a S61 helicopter under contract from a commercial helicopter company for search and rescue duties in the vicinity of the Shetland Islands. The need for this aircraft was determined due to increased fishing activity in the area. The Royal Air Force was initially requested to provide a dedicated SAR helicopter but refused, as the SAR responsibility of the Armed Forces is for civil aircraft and Armed Forces incidents and

UNITED KINGDOM HM COASTGUARD STATIONS



Source: United Kingdom Maritime Search and Rescue Organization

FIGURE 2.13

as such there was no requirement for a dedicated helicopter in the area.

The contracted S61 is on 30 minutes standby, 24 hours a day, 7 days a week (24/7/30) and is equipped with a winch.

The Royal National Lifeboat Institution (RNLI) is a voluntary organization incorporated for the sole purpose of saving life at sea. The RNLI is organized into 9 divisions each under the Authority of an Inspector of Lifeboats. In 1979 the RNLI operated 133 offshore lifeboat stations including 55 at which an inshore lifeboat was also available. In addition there were 67 inshore lifeboat stations (Fig. 2.14).

The RNLI maintains a fleet of offshore lifeboats which can reach a casualty 30 miles offshore within 4 hours of launching and which have an additional 4 hours search capability 30 miles from shore.

Responsibility for SAR within the Armed Forces rests with the Royal Navy and the Royal Air Force. Although Armed Forces resources are established primarily for military and civil aircraft incidents, HM Forces render assistance to vessels in distress wherever possible.

UNITED KINGDOM LIFEBOAT STATIONS

Source: United Kingdom Maritime
Search and Rescue Organization

FIGURE 2.14

RN and RAF SAR resources are coordinated by two co-located Maritime Headquarters/Rescue Coordination Centers (MHQ/RCC) located at Plymouth and Pitreavie. The RCCs coordinate the use of SAR resources in incidents involving civil or military aircraft in distress and the air aspects of all other SAR operations. Therefore, if aircraft assistance is required for a marine incident, Coast Guard would approach the nearest SAR helicopter unit and the helicopter unit would inform the RCC.

The RAF provides a Nimrod long range patrol aircraft on 24/7/30 standby out of Kinloss and St. Mawgan. In the event that the aircraft is engaged in SAR duties another Nimrod is brought up to SAR standby. The Nimrod has a radius of action of 1000 nm followed by a 5 hour search period. It carries SAR equipment similar to that carried in a Buffalo.

RAF helicopters are deployed in pairs as shown in Fig. 2.15. Wessex MK1 and MK2 and Sea King MK1, MK2 and MK3 helicopters are used for SAR duties. All of the helicopters are fitted with a hoist and utilize a rescue technician who will descend on the hoist to assist a survivor. The particulars of the UK SAR helicopters are outlined in Table 2.34.

The standby posture for all SAR helicopters is 15 minutes standby for one helicopter and 1 hour standby for the second helicopter during daylight hours. During hours of darkness one Sea King helicopter in each location is on 45 minutes standby and one Wessex helicopter in each location is on one hour standby.

U.K. SAR HELICOPTER DEPLOYMENT

Source: United Kingdom Maritime Search and Rescue Organization

FIGURE 2.15

Table 2.34

UK SAR AIRCRAFT

Type (H) Helicopter (FW) Fixed Wing	Performance			Litters or Passengers	Operating Limitations	Remarks and Specialist Equipment
	Speed kts	Endurance hrs	Radius of Action nm			
Wessex Mk 1 (H)	90	2·30	80	6 Litters or 13 Pax	55 kts max wind 30 kts crosswind	Vam, Vfm, UHF, U, HF, VS, DE, ME, HT, S, ELH (4000), LNC
Wessex Mk 2 (H)	100	3·30	110	8 Litters or 14 Pax	55 kts max wind 30 kts crosswind	Vam, Vfm, UHF, HF, U, RC, VS, DE, ME, HT, S, ELH (4000), LNC
S–61N (H)	110	3·50	150	10 Pax	50 kts max wind normally Nil in emergency	Vam, Vfm, HF, US, A, RC, DE, ME, HT, S, ELH (4500), R, LNC
Sea King Mk 1 + 2 (H)	90	4	200	2 Litters or 10 Pax	45 kts max wind 30 kts crosswind	Vam, Vfm, UHF, U, HF, VS, DE, HT, S, ME, ELH (6000), R, FNC
Sea King Mk 3 (H)	115	5	270	6 Litters or 18 Pax	45 kts max wind 30 kts crosswind	Vam, VA, Vfm, VF, UHF, U, HF, VS, RC, DE, ME, HT, S, ELH (6500), R, FNC
Nimrod (FW)	284	9	1200	NIL	25 kts crosswind	Vam, UHF, U, HF, VS, DE Para Flares

Source: United Kingdom Maritime Search and Rescue Organization

Table 2.34 (con't)

RESCUE CO-ORDINATION CENTRES' AIRCRAFT FACILITIES

Key to Equipment and Capabilities

C	=	Communications Equipment
E	=	Special Equipment and Capabilities
N	=	Navigational Equipment
NK	=	Details Not Known

Communications (C)

HF	=	HF Comms
UHF	=	UHF Comms
Vam	=	VHF AM Comms
Vfm	=	VHF FM Comms

Navigation (N)

DCA	=	DECCA
H	=	HF Homer
PNE	=	Precision Navigation Equipment (Doppler/INS)
R	=	Radar
RC	=	Radio Compass
U	=	UHF Homer
VA	=	VHF/AM Homer
VF	=	VHF/FM Homer

Special Equipment and Capabilities (E)

A	=	Amphibious Capability
DE	=	Droppable Survival Equipment
DR	=	Droppable Radio Equipment
ELH	=	External Load Hook (Max Load)
FNC	=	Full Night Capability
HT	=	Hoist
LNC	=	Limited Night Capability
ME	=	Medical Equipment
MO	=	Medical Officer
R	=	Search Radar
S	=	Lifting Strop
VS	=	Visual Signals Equipment

Personnel

HM Coast Guard mans MRCCs with a Regional Controller and several Controllers while MRSCs are controlled by a District Controller. HM Coast Guard currently has about 560 regular officers, almost all of whom have practical sea-going experience having been recruited from the Royal Navy and the Merchant Service.

Statistics

HM Coast Guard handle about 4,000 incidnts per year. A breakdown of the incidents for 1982 is shown in Table 2.35.

TABLE 2.35

HM COAST GUARD
INCIDENT STATISTICS
JANUARY - DECEMBER, 1982

	TYPE OF VESSEL		PLEASURE CRAFT						SHORE RESCUE										
	COMMERCIAL VESSELS	FISHING VESSELS	POWER BOATS	SAIL BOATS	SMALL CRAFT	INFLAT-ABLES	MEDICO	AIR CRAFT	SKIN DIVERS	CLIFF RESCUE	CUT OFF BY TIDE	SHORE RESCUE	DISTRESS REPORTS	MISC. CRAFT	MISC. PERS.	TOTAL	PERS. ASSISTED	LIVES LOST	COLLISIONS
ABERDEEN	15	56	27	24	6	11	18	2	5	15	8	6	102	6	8	311	639	23	2
YARMOUTH	4	99	101	61	8	38	46	3	0	25	30	21	277	28	27	733	1247	15	2
DOVER	4	32	90	117	7	12	29	1	1	5	8	3	197	9	14	537	940	13	10
BRIXHAM	21	76	128	261	12	29	87	2	15	75	20	43	401	40	33	1257	1763	65	7
SWANSEA	9	53	126	114	23	45	38	0	8	68	67	54	184	8	29	827	1463	37	2
CLYDE	9	60	64	59	8	11	24	1	1	15	6	16	173	15	16	482	854	28	5
TOTAL	62	376	536	636	64	146	242	9	30	203	139	143	1334	106	127	4187	6906	181	28

2.8.3 SAR - Norway

The Norwegian SAR service is carried out as a cooperation between a number of government agencies, voluntary organizations and private companies under the direction of a specific coordinator, the Police Force.

Responsibilities

Norway, like Canada, is a signatory of the ICAO Convention, including Annex 12 which states that each contracting state is required to provide assistance to aircraft in distress in its territories and territorial waters.

The International obligations for marine search and rescue for Norway are outlined under SOLAS and the International Convention on Maritime Search and Rescue worked out by IMO.

In addition to incidents involving aircraft or marine vessels the Norwegian SAR system also accepts responsibility for the rescue of persons in inland areas.

The overall coordination of the Norwegian SAR system is the responsibility of the Ministry of Justice and Police which has delegated this responsibility to the Police Force.

As in the United Kingdom no special SAR equipment or

facilities are provided for the North Sea Oil Industry. The responsibility for search and rescue for the oil industry is deemed to lie with the industry itself. According to the Civil Defence Law, enterprises with more than 40 employees are required to establish an internal rescue organization with necessary equipment and rescue teams to handle rescue work within the area of that enterprise until the public SAR service arrives.

Organization, Equipment and Deployment

The Police Force is responsible for the coordination of all groups involved in SAR operations. The Police Force funds and operates two Rescue Coordination Centers (RCCs) located in Stavanger and Bodo. In addition, general Rescue Sub Centres (RSCs) have been established at 54 Police Headquarters and Air Rescue Sub Centers at 16 airports and Air Force Bases (Fig. 2.16 and Fig. 2.17).

The RCCs have a direct communications link to the 13 principal Coastal Radio Stations along the coast which maintain a listening watch for vessels in distress as well as with the RSCs and the various groups which provide SAR resources and services.

The Ministry of Justice and Police has purchased 10 Westland Sea King helicopters for search and rescue duties. These helicopters are manned, operated and maintained by the Royal Norwegian Air Force. These helicopters are deployed in pairs in

Organization diagram for the search and rescue service

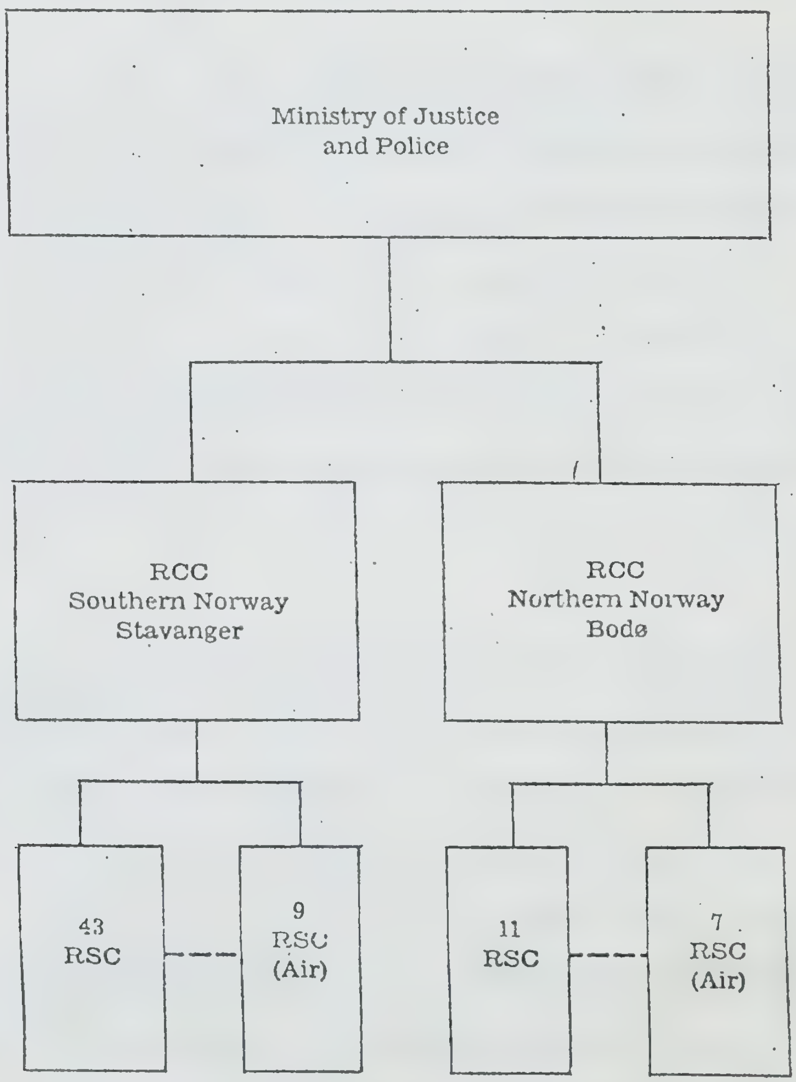


FIGURE 2.16

Source: <u>The Norwegian SAR Service</u>

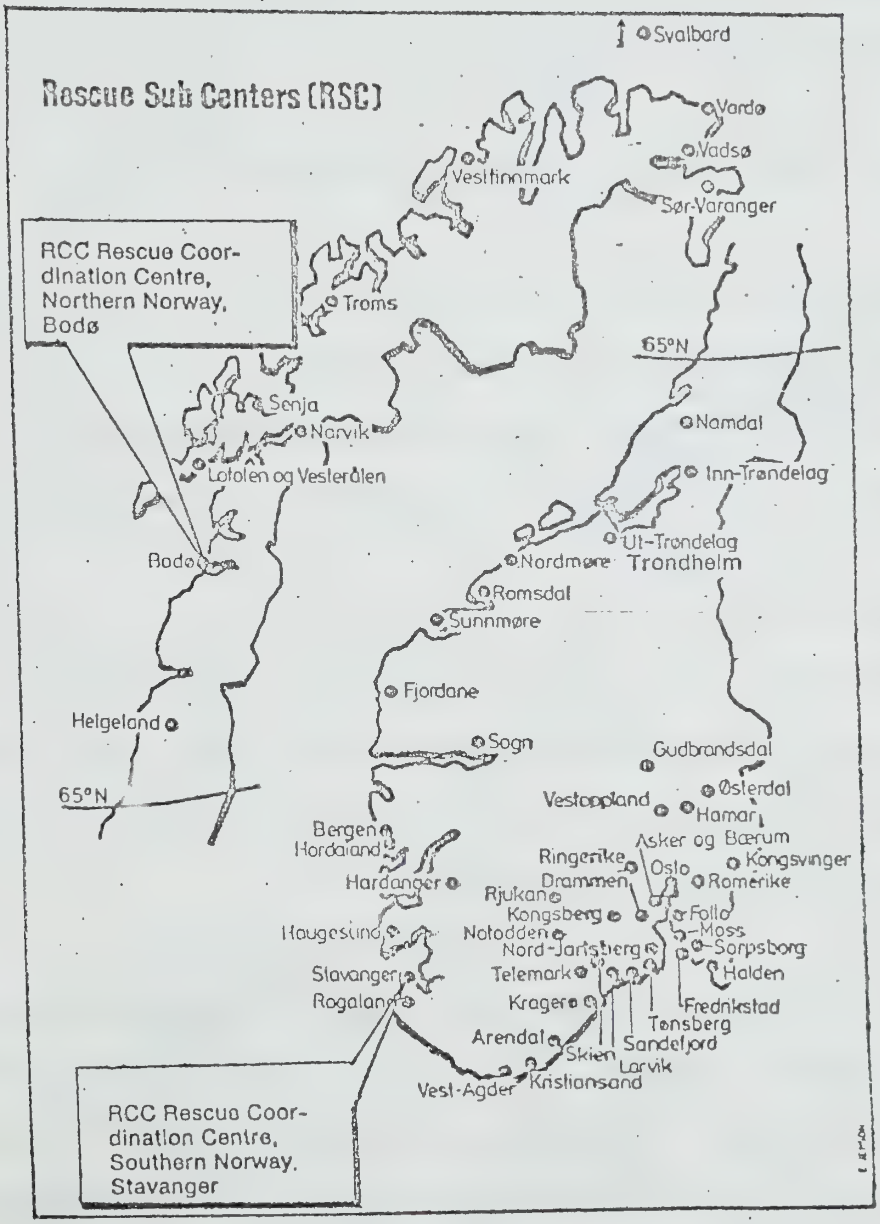


FIGURE 2.17

Source: <u>The Norwegian SAR Service</u>

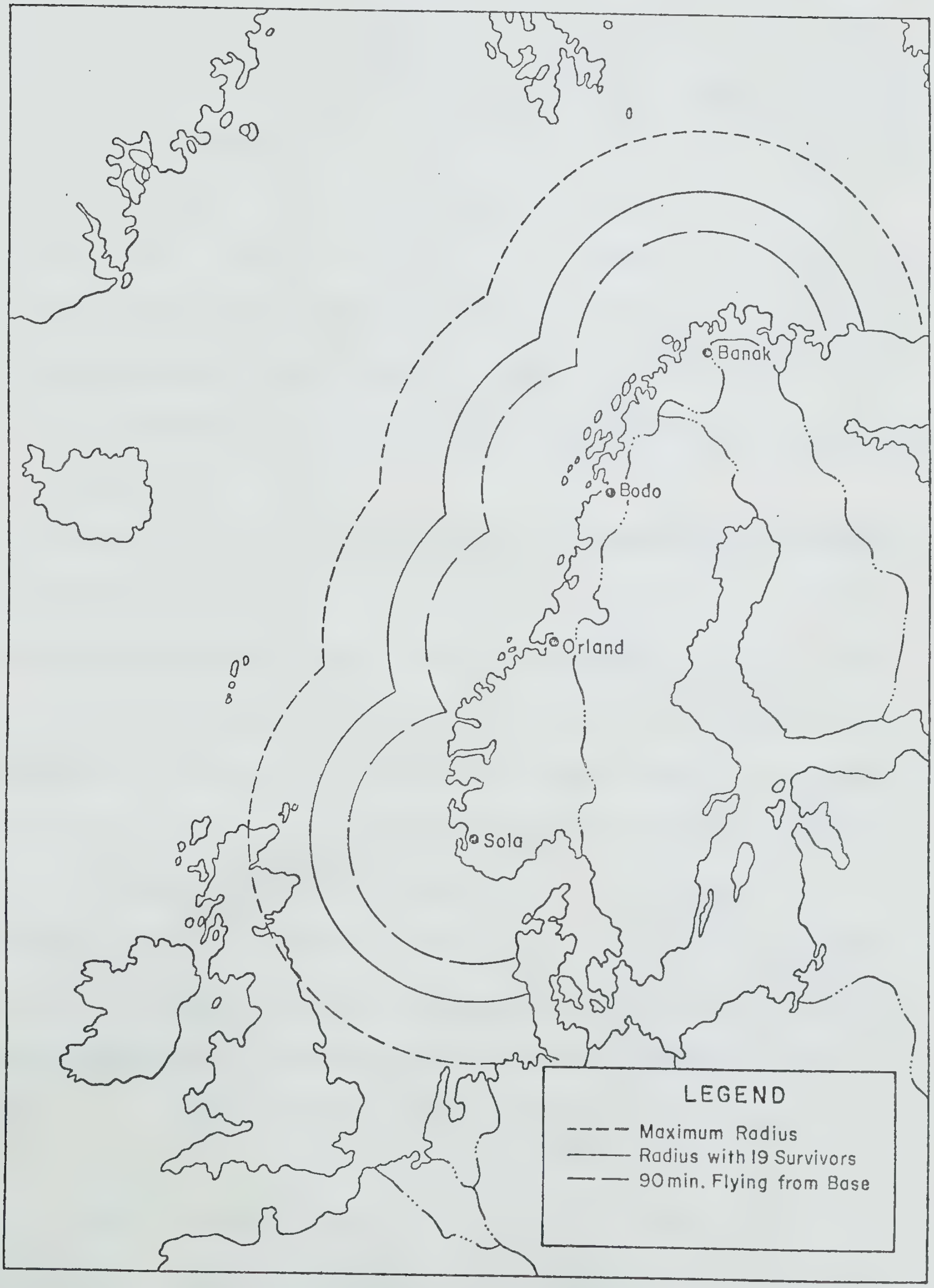
four locations along the coast (Fig. 2.18) with two helicopters kept in reserve for maintenance and repair. One helicopter at each base is at readiness at any time. The capabilities of these helicopters are similar to those of the Sea King MK3 used in the United Kingdom SAR service (Table 2.34). These helicopters are equipped with rescue winches and utilize a technician who descends on the winch to assist survivors.

The Police Force also has available communications and transportation facilities and some standardized light rescue equipment stored in small trailers. Dedicated marine search and rescue resources in Norway are provided by the Norwegian Society for Sea Rescue (NSSR).

The NSSR is a private humanitarian organization dedicated to saving life at sea. Until several years ago it was funded entirely by private contributions but now receives 60% of its funds from the Norwegian government.

The NSSR operates 29 ocean going lifesaving vessels, and 8 smaller inshore vessels, all of which have been donated, which are stationed from the northern tip of Norway to the Coast between Norway and Sweden. These vessels have communications facilities, search radar, fire fighting equipment and salvage pumps. Operation of these vessels is coordinated by the RCCs.

LOCATION OF THE SEA KING BASES



Source: The Norwegian SAR Service

FIGURE 2.18

Non-dedicated SAR resources are available from several sources:

- The Royal Norwegian Air Force has a number of Bell UH-1B short range helicopters which are equipped with rescue winches. The RNAF also has Lockheed P3B Orion and C130 Hercules aircraft available for searches.

- The Royal Norwegian Navy often provides vessels for SAR operations and the Norwegian Coast Guard, which is integrated with the Navy, has a number of vessels as well as a Westland Sea Lynx helicopter with a rescue winch.

- Civilian helicopter companies of which the main operator is "Helikopter Service Ltd." have helicopters of various types which can be used for SAR duties. Helikopter Services Ltd. operates Sikorsky S61N and Bell 212 helicopters for oil industry transportation. Rescue winches are stored onshore and at some offshore installations.

- The Pilot Service, the Harbour Service, the Directorate of Fisheries, the State Pollution Control Authorities and the Norwegian State Railways have vessels and Rescue Equipment which can be utilized for SAR operations.

- The Royal Norwegian Army, The Civil Defence Forces, the Public Health Service, the Ambulance Service, The Municipal

Fire Departments, the Directorate of Civil Aviation, the Norwegian Red Cross, Civilian Airlines and Merchant Vessels can also provide SAR assistance.

Personnel

RCCs are lead by a rescue staff with representatives from the following agencies:

- The Chief of Police (at Stavanger and Bodo) who acts as Chairman
- The Royal Norwegian Navy
- The Royal Norwegian Air Force
- The Air Traffic Service (the senior Air Traffic Controllers from Stavanger and Bodo)
- The Telecommunications Administration (the directors of the Coastal Radio Stations at Stavanger and Bodo)

Each RCC has a permanently appointed Senior Rescue Controller and seven Rescue Controllers who are recruited from the Air Traffic Service, the Air Force, the Navy and the Merchant Marine. All rescue controllers attend courses at the U.S. Coast Guard SAR school at Governor's Island, New York. Rescue Sub Centers are manned by senior officials and executive officers of the Police Force while Air Rescue Sub Centers are led by the Senior Air Traffic Controllers and manned by Air Traffic Controllers.

Statistics

Norwegian RCCs handle about 1800 incidents per year. A breakdown of these incidents for 1983 is shown in Table 2.36.

TABLE 2.36

NORWEGIAN SAR INCIDENTS (RCCs STAVANGER AND BODO) 1983

	RCC STAVANGER	RCC BODO	TOTAL
MARITIME SAR OPERATIONS	389	226	615
Fishing Vessels	36	125	161
Pleasure Craft	223	64	287
Merchant Ships	53	37	90
False Pyrotechnical Distress Signals	77		
AERONAUTICAL SAR OPERATIONS	22	19	41
INLAND SAR OPERATIONS	324	84	408
AIR AMBULANCE OPERATIONS	154	366	520
Maritime	24		
Inland	130		
ACTIVATED EMERGENCY RADIO BEACONS	68	147	215
Sea (EPIRB'S)			
Air (ELT'S)			
TOTAL	957	842	1799

CHAPTER 3: OIL INDUSTRY SEARCH AND RESCUE

3.1 INTRODUCTION

During 1983[29] seven oil companies conducted drilling operations off the East Coast of Canada. These companies employed 17 drilling units owned by 12 different drilling contractors. The drilling units included four drillships, nine semisubmersibles, and four jackups. To support these drilling units, 40 vessels owned by eleven different companies as well as 13 helicopters belonging to three different companies were employed.

Each of these companies, be they oil companies. drilling contractors, supply vessel companies or helicopter companies have specific policies and procedures which generally have some common ground but vary in details from company to company.

Because of the large number of possible permutations and combinations of company relationships the industry will be discussed in a more general fashion than was government.

The discussion of search and rescue in this chapter will focus on three areas:

- the Labrador coast and Davis Straits where drilling takes place during the summer months usually with drillships.

Supply vessels for drilling units in this area usually transit between the units and St. John's. Helicopter support is generally based on the coast of Labrador, the location being dependent upon the location of the drill site;

- the Grand Banks/Hibernia area where drilling takes place year round. Semisubmersibles are used almost exclusively, in this area. Supply vessel and helicopter support for this area is based in St. John's;
- The Scotian Shelf area where drilling also takes place year round using semisubmersibles and, in shallower waters, jackups. Supply vessel and helicopter support is usually based in Halifax for this area.

Some drilling has taken place in the Gulf of St. Lawrence and in the Bay of Fundy but these areas will not be considered in detail as the rescue problem presented in these areas is not as severe as that presented in the three areas considered.

3.2 RESPONSIBILITIES AND OBJECTIVES

3.2.1 Industry Perception

The offshore oil and gas industry recognizes a responsibility to provide a degree of self-help in Search and Rescue. The "Offshore Safety Task Force Report to the EPOA/APOA Safety Committee"[30] recommended that "industry must develop survival/rescue equipment and rescue training guidelines for standby/rescue vessel and helicopter support". This recommendation acknowledges a responsibility on the part of industry to provide some rescue capability but the report clearly suggests that rescue capability should be developed in conjunction with the government SAR system. Consequently, the report recommends "ongoing dialogue between industry/government Search and Rescue and the Coast Guard should be initiated by industry, to assist and promote additional and more effective Search and Rescue and Coast Guard emergency response support for offshore petroleum activities".

An examination of industry contingency plans[31 to 36] indicates that the industry regards the government SAR system as a major resource in effecting a rescue. Joint alert plans[37,42] developed by the operators include the notification of and request for aid from the government SAR system early in the rescue response.

The main area of uncertainty in terms of industry's responsibility for providing rescue resources lies in air resources. Industry has accepted the responsibility for providing initial rescue response to a MODU incident with the provision of standby vessels but appears to be reluctant to utilize helicopters for rescue in the same manner as SAR helicopters. The difference here lies in the rescue technique employed. SAR helicopters utilize specially trained rescue personnel who are lowered down a winch to assist the survivor. The industry regards this technique as being undesirable as it poses additional danger to another person.

Search and rescue operations are more hazardous than carrying passengers which is the normal role of the industry helicopters. For example, rescue operations may require that helicopters hover at low altitudes above the water or a deck for extended periods of time which creates a more hazardous situation inc ase of engine failure than would normal flying.

The operators and helicopter companies are concerned about the additional risk placed upon personel and equipment by rescue operations and for this reason many feel that rescue operations are better carried out by the SAR system. It has also been indicated that some of the industry helicopter crews do not want to accept the responsibility or risk involved in conducting rescue operations. The flight crews are employed to fly passengers to and from the rigs, a job which does not involve an unusually high element of personal risk and which usually does

not put the flight crew in a position where they are responsible for the lives of persons other than their passengers.

The flight crews may not wish to expose themselves to the additional personal risk involved in rescue operations nor to the additional responsibility for rescuing, or failing to rescue, persons in life or death situations.

Another area of concern for the oil companies helicopter companies and the flight crews is the possibility of legal action should a survivor be injured or killed while attempts are being made to effect a rescue. This concern applys equally when attempting rescues of oil industry personel or of personel from other industries, such as fishing, in cases where the industry helicopter may be requested to assist in a rescue.

The operators are of the opinion that the industry helicopters should be used to search for survivors and to assist in rescue, where possible, utilizing passive rescue modes (EMPRA baskets, S.E.A. kits). Rescues involving the winching of survivors or involving the lowering rescue personnel on the winch are better handled by government SAR resources, in the opinion of many of the operators, as they are fully trained in this technique.

3.2.2 Government Perception

The regulatory agencies (COGLA and NLPD) clearly demand that the industry accept responsibility for initiating rescue efforts

following an incident involving a MODU. Both the COGLA and NLPD regulations require a vessel to stand by the MODU at all times. Recent guidelines[43, 44] issued by each agency outline in some detail the rescue equipment which must be carried on these vessels.

Alert plans which outline the procedures used by the operator to bring the organization to an advanced state of readiness in the face of predicted or known environmental conditions must be submitted. In addition, Joint Alert Plans are required for the purpose of coordinating the response of other operators to an emergency. These alert plans include procedures for the evacuation of MODUs under preset conditions.

The guidelines issued by COGLA and NLPD also require that a common vessel and helicopter watch be developed in Newfoundland (COGLA and NLPD) and in Nova Scotia (COGLA) in order to facilitate an immediate response to an emergency.

COGLA and NLPD each require that the operators in Newfoundland provide a helicopter dedicated to search and rescue. The NLPD specifies that this helicopter is to be outfitted with a winch. While the COGLA guidelines do not specify a winch it is understood that this is also a COGLA requirement.

COGLA has also required that operators on the Scotian Shelf establish a fuel base and temporary shelter arrangements on Sable

Island for the transfer of personnel by helicopter from MODUs in the event of an emergency.

Operators are also required to submit contingency plans prior to receiving approval to drill which deal to some extent with the rescue of personnel. These include:

a) the serious injury or death of a person;

b) a major fire;

c) the loss or damge to support craft;

d) the loss or disablement of a drilling unit;

e) the loss of well control.

Through regulations and guidelines both COGLA and NLPD have clearly put the onus for at least an initial rescue response upon the industry. However, COGLA requires that Alert plans be closely coordinated with the government SAR system and states that the Department of National Defense (SAR) will assess and assist in the training of helicopter crews in search and rescue.

The regulations also require that equipment be available to ensure the survival of personnel while awaiting a rescue. Survival suits are required on MODU's and supply vessels and immersion suits are required for passengers transiting on helicopters.

The regulations also detail the requirements for lifeboats and liferafts on MODU's and supply vessels and for liferafts in helicopters.

3.3 RESCUE MANAGEMENT SYSTEM

3.3.1 Joint Alert Plans

Operators on the Grand Banks and the Scotian Shelf have developed joint Alert Plans which are designed to coordinate the rescue response of all operators in the area to situations which have the potential for developing into an emergency. These Joint Alert Plans are in addition to the individual operators internal alert response or contingency plans. Copies of the Joint Alert Plans are availble on each drill rig, and standby vessel, at the operators shore base and a copy is supplied to the Regulatory agencies.

The Plans specify that an alert may be of two types:

- an Individual Operator Alert whereby other operators are not required to assist;
- a Multi-Operator Alert where an operator calls upon support from one or more of the other operators.

Conditions are specified in the plan which require that an alert will be declared. These conditions include:

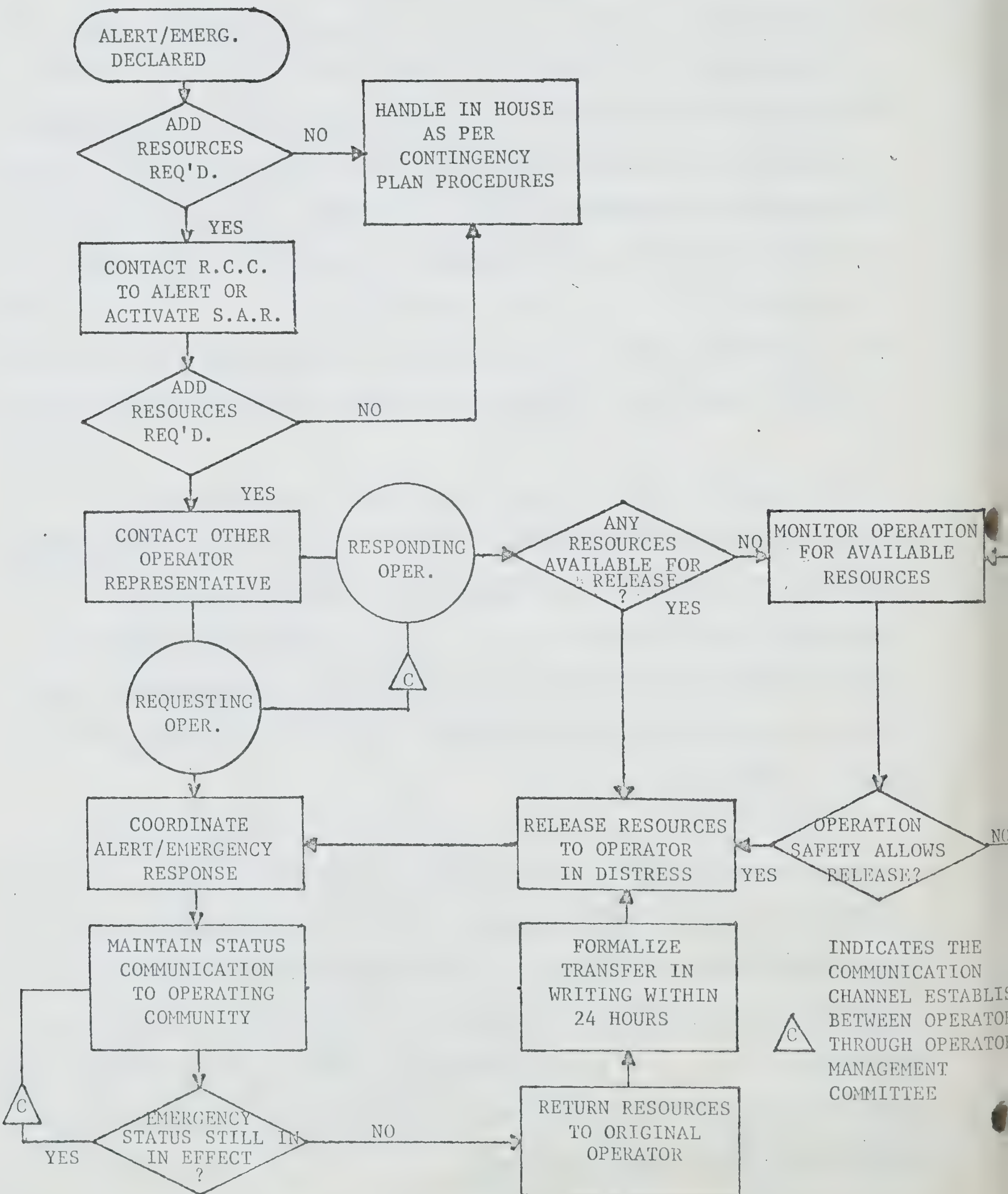
1) severe wind forecast (80 kts. and above);
2) ice conditions which could pose a threat to operations (note: The Grand Banks plan states ice conditions which actually pose a threat to operations);

3) moderate structural damage or ballast system problems with high actual or severe wind forecast;
4) well control problems with high actual or severe wind forecast;
5) any other condition or situation included in the emergency response or contingency plans of the individual operators;
6) severe wind forecast (70 kts. or above) in the presence of ice which could pose a threat to operations (Grand Banks only);
7) actual high wind (40 to 70 kts.) in the presence of ice which could pose a threat to operations (Grand Banks only).

The plans outline the personnel who are authorized to declare an alert. These include but are not limited to the Senior Manager for the area or his designate, members of the rig supervisory team, members of the onshore supervisory team and aircraft or vessel captains under contract to the operator. The decision to declare a Multi-Operator Alert rests with the operator affected.

When a Multi-Operator Alert is declared all operators involved are required to provide resources as available to support the affected operator. The Joint Alert Plans include an Operators Emergency Resources Sharing Plan which outlines the procedures (Fig. 3.1) to be followed in requesting resources from government and industry sources and also lists contacts in each company and equipment available.

CONTACT PROCEDURE FOR REQUEST
FOR EMERGENCY RESOURCES



Source: GRAND BANKS OPERATORS EMERGENCY RESOURCE SHARING PLAN

FIGURE 3.1

An Operators Management Committee (OMC) consisting of one designated member from each company has been established to coordinate responses to Multi-Operator Alerts. The Committee constitutes the communication link between operators, functions as a joint advisory group and heads the Alert Response Organization (Figure 3.2).

As stated in the plans, the Alert Response Organization is designed to:

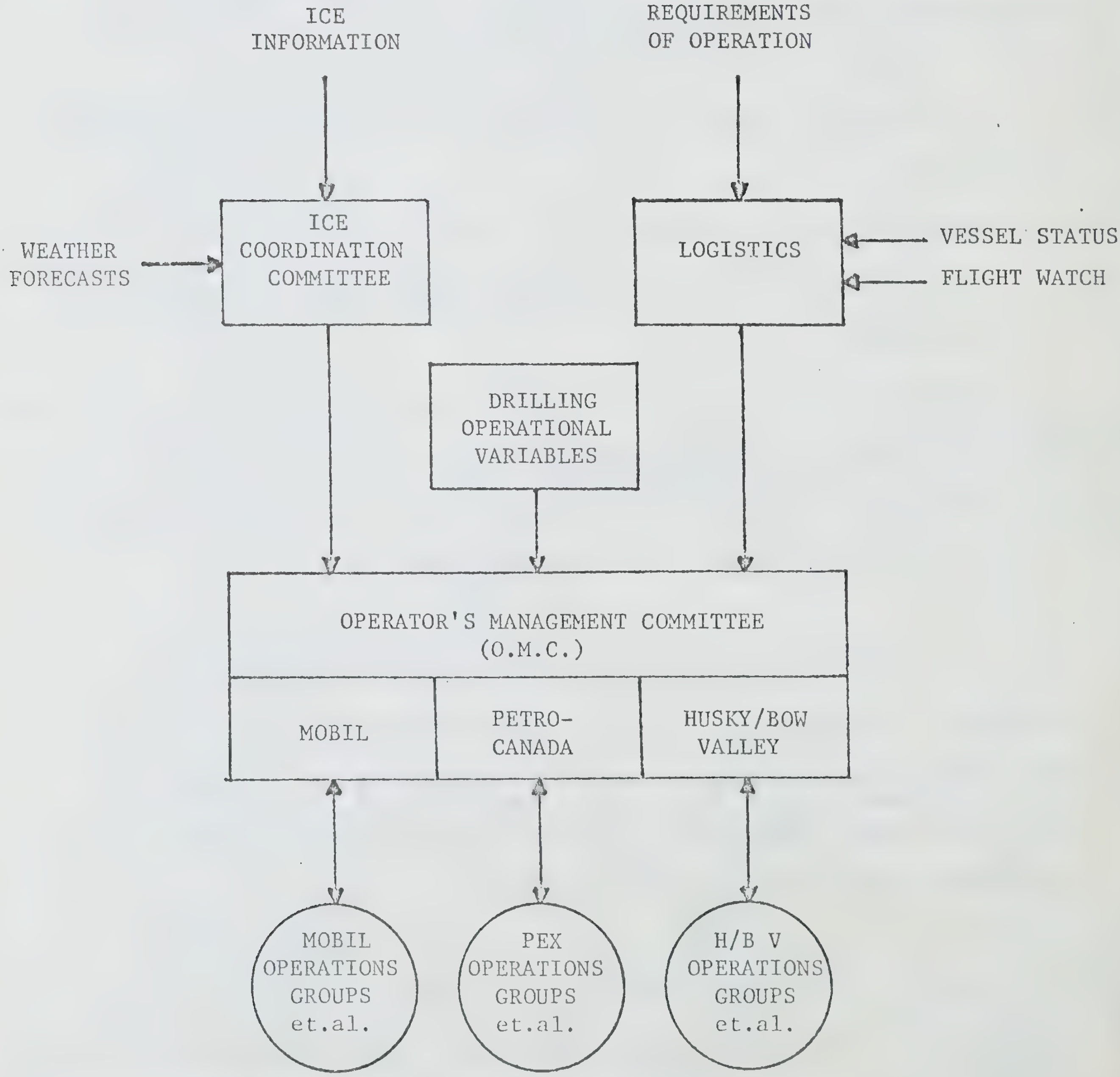
- coordinate and allocate the combined resources of all the operators involved in the area should this be deemed necessary;
- bring a focussed effort to bear on the problem or situations to prevent an emergency;
- switch smoothly into an Emergency Response in the event the situation develops into an emergency.

Operators Management Committee Decisions regarding the movement of equipment, supplies and personnel are disseminated by the individual OMC representatives through their respective organizations. Therefore, each operating company directs their own operations on the advice of the OMC.

Several plans and agreements have been developed by the operators to complement the Joint Alert Plans. The Flight/Marine Monitoring Service provides monitoring of all industry vessels and helicopters so that their location is known at all times.

FIGURE 3.2

ORGANIZATIONAL STRUCTURE OF THE OPERATORS
INVOLVED IN A MULTI-OPERATOR ALERT



Source: GRAND BANKS MULTI-OPERATOR ALERT RESPONSE PLAN

The East Coast Offshore Operations Operator's Temporary Assignment Agreement re Support Craft outlines the terms and conditions for the use of helicopters and supply vessels under the Emergency Resources Sharing Plan and the Joint Alert Plan.

The Grand Banks Operators Joint Ice Management System provides a joint ice status surveillance and management program.

The procedures which are followed following the calling of an alert whether it be a Single Operator or Multi-Operator Alert are outlined in each of the companies Alert Response plans.

The Alert Response Plans developed by each of the Companies outline the responsibilities of the company's management when an alert is declared and the procedures to be followed to bring the management to an advanced state of readiness.

Although the plans differ slightly between the companies they all include the forming of an Alert Organization which is available at all times during the Alert. When an alert is declared, the personnel who are part of the Alert Organization are called into a designated Alert Room. The SAR system is notified that an Alert has been declared and the appropriate regulatory agencies are contacted. The Alert Organization remains on continuous standby until the Alert is terminated and prepares to initiate the company's contingency plan should it become necessary.

3.3.2 Oil Company Contingency Plans

Operators off the East Coast of Canada are required by regulation to prepare contingency plans for the following types of emergencies:

a) serious injury or death

b) a major fire

c) loss or damage to a support craft

d) loss or damge to a drilling unit

e) loss of well control

f) relief well drilling arrangements

g) hazards unique to the well site

h) oil spills

Although the plans for relief well arrangements and oil spills do not include a search and rescue component, the remainder of the plans all can have a rescue requirement.

The purpose of these contingency plans is to define the responsibilities of key individuals and outline the basic procedures for dealing with an emergency.

COGLA requires the following items, which may be rescue related, to be documented in the contingency plans:

- responsibilities of key personnel
- first aid and medical facilities

- primary and secondary means of evacuation
- weather limitations on evacuation procedures
- availability of onboard firefighting equipment
- procedures for location of downed aircraft
- person overboard recovery facilities and procedures
- primary and secondary communications facilities
- a summary of external response procedures to be followed in the event of a loss of well control
- cooperative arrangement for SAR, ice and weather services and equipment sharing
- precautions for hazards unique to the drill site (iceberg avoidance and other environmental alert criteria)
- vessels and aircraft under contract

An examination of the contingency plans of the individual oil companies reveals that the criteria required by COGLA in the plans is met and in many cases the plans go into more detail than is required by regulation.

The contingency plans outline the overall procedure to be carried out in an emergency. These are supplemented in more detail by lifeboat boarding and launching procedures, well control manuals, operations manuals and other specific manuals and procedures.

3.3.3 Vessel Watch

Each oil company operating off the East Coast of Canada maintains a 24-hour a day radio watch for the drilling units and supply vessels which it has under contract.

Standby and supply vessels must report in to the oil company radio operator at any time that they arrive or depart from any location including the supply base or the rig and at designated four-hour time intervals while in transit. The information reported includes:

- present activity
- position
- speed
- heading
- estimated time of arrival

In the event of an emergency the vessel can therefore call either the oil company radio operator or the Coast Guard on a 24-hour a day basis.

If a vessel fails to report within 15 minutes after its scheduled reporting time, the radio operator will attempt to contact it. If this fails he will request the rigs or nearby vessels to attempt to contact the vessel in question. If all attempts to contact the vessel fail then the radio operator will

advise the appropriate personnel within the oil company and the contingency plan to deal with the loss of a support vessel will be put into effect.

This plan includes advising SAR of the situation and requesting assistance, dispatching other vessels in the area to render assistance, and advising the Flight Following Service of the situation so that industry helicopters can be mobilized.

If a vessel places a distress call the radio operator notifies SAR immediately and then contacts the appropriate oil company personnel so that industry resources can be mustered to deal wth the situation.

In either case, a Joint Opertaor Alert may be called at the discretion of the oil company involved.

Vessel positions from each company in the area are forwarded to the Flight Following Service each morning and during the hours of operation of that service.

3.3.4 Flight Watch

A common aircraft watch service termed Central Flight Following has been established in St. John's and Halifax. All of the oil companies who operate out of these two locations

participate in and contribute funding to this service which is managed on a contract basis.

Central Flight Following[45] provides each helicopter with weather information at the final destination and enroute, prior to take off, and provides a radio watch during all times when industry helicopters or other aircraft are flying. Aircraft are required to call in to Central Flight Following at predetermined checkpoints along their flight path to and from the rigs. These checkpoints correspond to 30 nm distances along the path and as such, the time period between transmissions may vary according to the type of helicopter in use and the wind conditions. In general the time between calls will vary from a minimum of 10 minutes to a maximum of about 25 minutes in the case of a slower helicopter facing high headwinds.

At each checkpoint pilots are required to provide their present position (checkpoint) and their estimated time of arrival (ETA) at the next checkpoint.

If an aircraft fails to check in within its specified ETA for the next checkpoint a three phase alerting sequences goes into effect.

If the aircraft is overdue by three minutes the radio operator will attempt to contact it, failing this he will contact the rigs or other sources to determine if contact can be made.

If the aircraft is overdue by 10 minutes or the pilots declare an emergency with the possibility of ditching the radio operator, alerts SAR, the helicopter operators base, the oil company, and the supply vessels in the area.

If the aircraft is 30 minutes overdue the radio operator will dispatch any available hoist equipped helicopter, dispatch any supply vessels in the area, and confirm the emergency with SAR.

Central Flight Following maintains a continuous plotting board of all helicopter movements and the locations of all supply vessels under contract. Supply vessel locations are obtained from the individual oil companies every four hours.

The Central Flight Following facilities include HF and VHF radios for communications with helicopters, rigs and supply vessels. A back-up generator is installed in the event of a power failure.

An automatic dialer telephone system is installed with a color coded listing corresponding to each alert phase. This system provides links to SAR, the oil companies, the helicopter companies and to medical facilities.

3.4 AIR EQUIPMENT AND PROCEDURES

3.4.1 Type Numbers and Location:

There are 13 helicopters used to ferry passengers offshore Newfoundland and Nova Scotia. Seven are operated by Okanagon and Sealand Helicopters out of Halifax International and six by Universal Helicopters and Sealand Helicopters out of St. John's Torbay. The aircraft are predominantly the Sikorski S-61N and the Aerospatiale Super Puma AS 332C and AS332L models.

3.4.2 Operational Limits

The Sikorski S61L/N and the Aerospatiale Super Puma AS332C/L are medium lift helicopters. The S61 was built in the early 1960's and the Super Puma in the mid 1970's.

The S61 is a twin turbine, single rotor helicopter. The S61N model is amphibious while the S61L is not. The aircraft has a cruising speed of 115kts, a normal radius of action of 215nm based upon IFR flight planning criteria and a 30 minute loiter time at maximum range. Although there are no manufacturer's wind limits for rotor start-up, the helicopter company's operations manuals specify a wind limit of 45k.

The Super Puma AS332L is a twin turbine, single rotor, non-amphibious helicopter. It has a cruising speed of 135kts, a

normal radius of action of 250 nm with a 30 minute loiter time at maximum range. As with the S61 there are no manufacturer's wind limits for rotor start-up but the helicopter company's operations manuals specify a wind limit of 55kts.

Both helicopters are authorized to take off from St. John's and Halifax with a 100 foot ceiling and 1/4 mile visibility and to land with a 200 foot ceiling and 1/4 mile visibility.

Rig landing limits for both aircraft are a 150 foot ceiling and 1/2 mile visibility.

The helicopter company operations manuals outline the other limiting factors for landing on rigs. These are:

	S61	AS332
Heave	45 feet	30 feet
Pitch - Eng. running	10°	12°
Shut down	10°	10°
Roll - Eng. running	10°	8°
Shut down	10°	5°
List	10°	12°

These limits apply to normal helicopter operations; i.e. passenger transport. Under emergency conditions the rig landing limits would be at the aircraft commanders discretion.

Both aircraft carry a range of communications equipment (HF, VHFam, VHFfm) which permit communications with marine craft,

other aircraft and shore bases. Navigation equipment include both area and point navigation and landing approach aids. The S61 and AS332 each have an automatic flight control system.

Both aircraft are capable of accepting a hoist and have an external hook for slinging loads. Although hoists are not permanently installed on the aircraft they are available for both the S61 and the AS332 in St. John's and Halifax and can be installed in less than 20 minutes.

3.4.3 Response Times

The oil and gas industry in St. John's is required, on a continuous basis, to provide a standby/rescue helicopter which can be equipped with a hoist.

The current practice is to have each operator, on a rotating basis, provide a helicopter which it has under contract as the standby/rescue helicopter. This means that the designated standby/rescue helicopter may be a different aircraft with a different crew each day.

Since some of the operators currently drilling on the Grand Banks have only one helicopter under contract the requirement to designate this aircraft as the standby/rescue helicopter often conflicts with requirements for crew transportation. If the designated standby/rescue helicopter is required to remain in St. John's then the operator no longer has resources available for crew transportation. For this reason the operators have

requested and received approval to use the standby/rescue helicopter for crew transportation but in this instance the helicopter must have the hoist on board, although it need not be installed.

If the helicopter crew is on standby at the shore base (St. John's) the aircraft could be airborne in 30 minutes from the time of notification. If the helicopter is being used for passenger transport it would land at the shore base or a rig, depending upon where it is at the time of notification and where the other helicopter ditched, discharge its passengers, install the hoist, refuel in most cases, and fly to the rescue site. Figures E-1A to E1-F of Annex E outline the times from the time of notification for the rescue helicopter to reach a crash site on a flight to an area 180 nm (approximate distance St. John's-Hibernia) from shore for various crash sites and different inflight locations of the rescue heicopter. These times assume that the rescue helicopter is always refuelled at the rig prior to commencing its inbound trip.

If the rescue helicopter is not refuelled at the rig, these times will be higher as in some instances flight planning considerations would preclude returning to the rig when the rescue helicopter is inbound even though that may be the most efficient point to discharge the passengers and fit the hoist.

When the standby rescue helicopter is based at the shore

base it could arrive at the furthest crash site (180nm from base) in about 2 hours. If the standby rescue helicopter is in flight and has been refuelled at the rig prior to commencing its inbound flight it could also arrive at any crash site within about 2 hours. However, in many instances the response time of the standby helicopter is longer if it is flying than if it were based in St. John's.

During the times when helicopters are not flying the crew of the standby/rescue helicopter is not required to remain on full alert. An examination of the time required to mobilize industry helicopters for emergency medical evacuation indicates that the helicopter can be airborne within about 1 hour of notification during the time when helicopters are not flying. Therefore a standby time of 1 hour has been assumed for helicopters in St. John's during non-flying hours and at all times for helicopters in Halifax.

Still air transit times were developed for Sikorski S61 and Super Puma helicopters for the Grand Banks and Scotian Shelf. These transit times assume an average speed of 115 knots and an endurance of 4 hours, 15 minutes for the S61 and a speed of 135 knots and an endurance of 4 hours, 15 minutes for the Super Puma. As with the SARCUP helicopters, a 45 minute fuel reserve, and a 30 minutes rescue time has been assumed.

It has also been assumed that there will be a rig in the Hibernia area at all times and that it could be used for refuelling and staging survivors.

The flight planning criteria for the Super Puma and S61 is the same as for the SARCUP. For an incident beyond Hibernia an industry helicopter out of St. John's could land and refuel at a rig at Hibernia. It could then depart on the rescue mission from Hibernia using the same rig as its destination and St. John's as its alternate. Under IFR rules the S61 and Super Puma would be limited to a radius of action of 130 nm and 165 nm respectively assuming that 30 minutes are required for a rescue.

A similar situation exists for industry helicopters out of Halifax, refuelling on Sable Island.

Figure 3.3 and 3.4 illustrate the flying times for S61 and Super Puma helicopters out of St. John's and Halifax while Figure 3.5 and 3.6 assume that helicopters will be based at Yarmouth if drilling is conducted on the Southern Scotian Shelf (Point G).

Super Pumas out of Halifax can reach all points on the Scotian Shelf while S61's cannot reach the extreme southern end. However the outermost times on these figures do not represent the maximum endurance of these helicopters.

Assuming a 1 hour standby at all times for helicopters in Halifax, rescue times on the edge of the Scotian Shelf leases average from 2½ to 3 hours with the most distant locations requiring up to 4 hours.

S61's and Super Puma's out of St. John's cannot conduct rescue missions in the northeastern and southern portions of the Grand Banks although the Super Puma has more range capability than the S61. At the present time there is no drilling being conducted in these areas and there are only a few leases in the southern area. If drilling were conducted in these areas, longer range helicopters would probably be required for crew transport.

Assuming a ½ hour standby during daylight hours, rescue times on the Grand Banks range from about 2½ hours in the Hibernia area to 3½ to 4 hours along the edge of the leases. Rescue times at night (1 hour standby) would be ½ hour longer.

3.4.4 Rescue Procedures

Industry helicopters have four techniques at their disposal to rescue or assist persons in distress. They are: dropping a survival package, landing the helicopter on the water or on deck and assisting survivors to board the aircraft, the EMPRA net slung from the external hook and winching survivors into the helicopter using a hoist and a Billy Pugh type of net.

Figure 3.3

TRANSIT TIME - SUPER PUMA

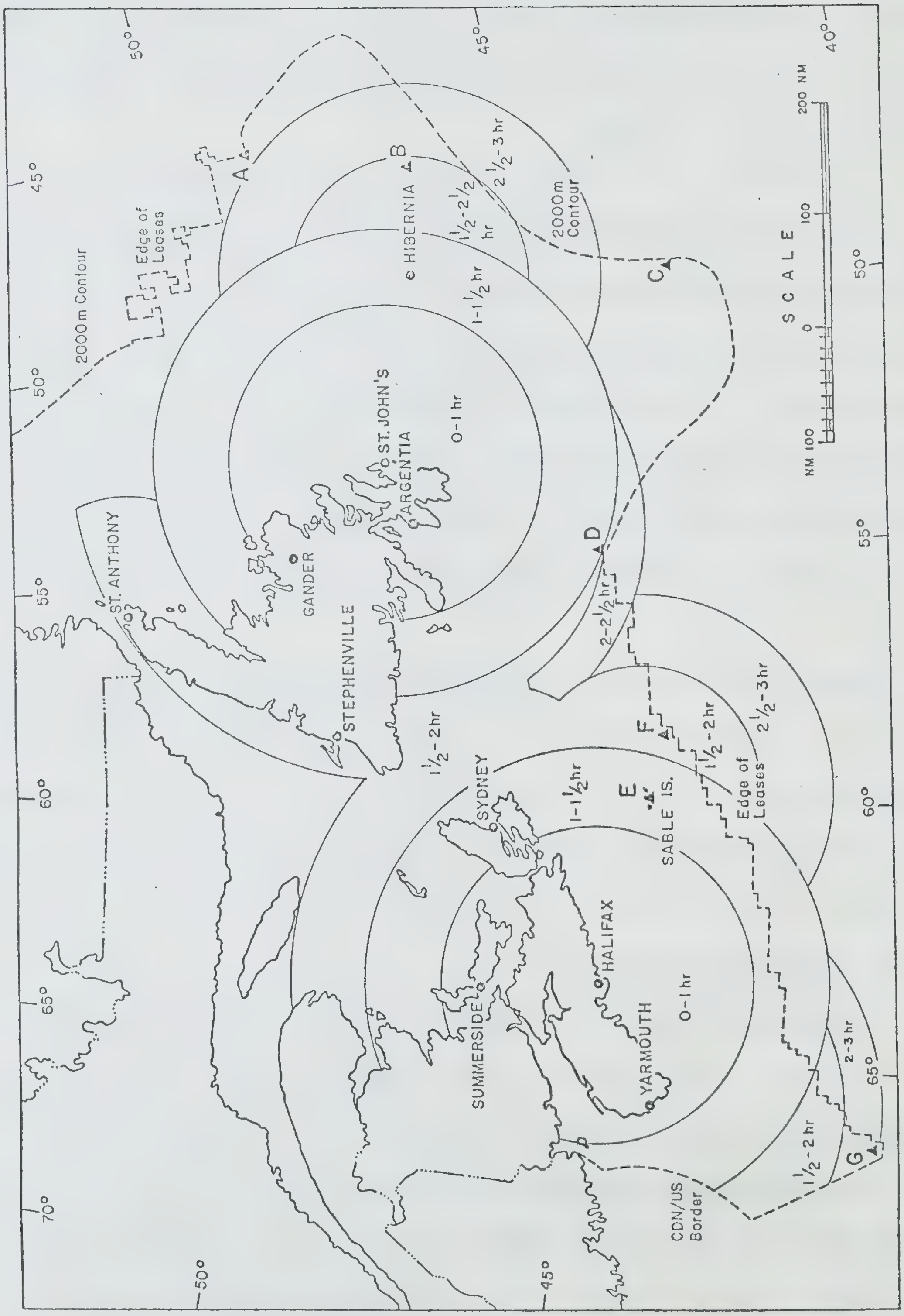


Figure 3.4

TRANSIT TIME - S61

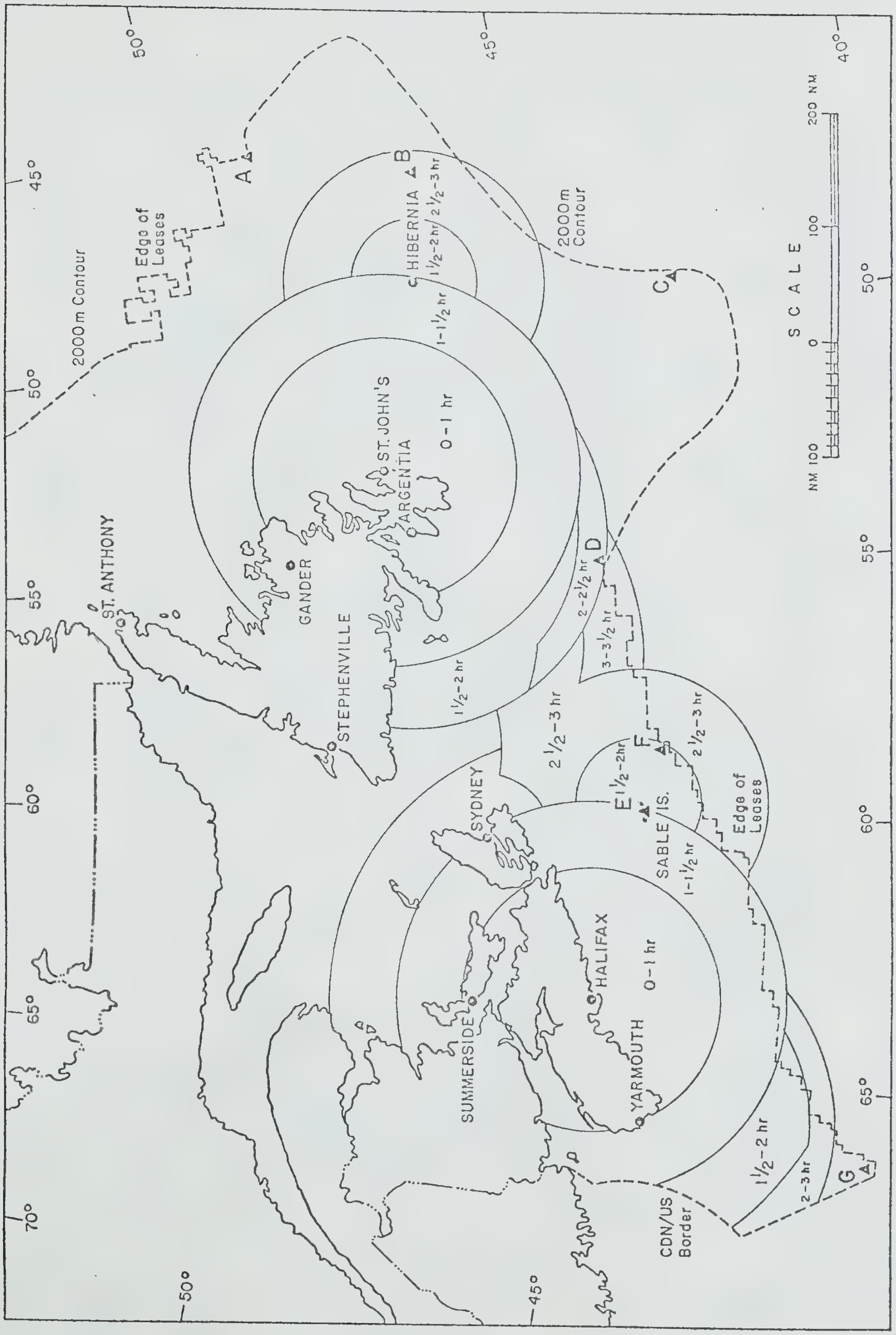


Figure 3.5

TRANSIT TIME - SUPER PUMA

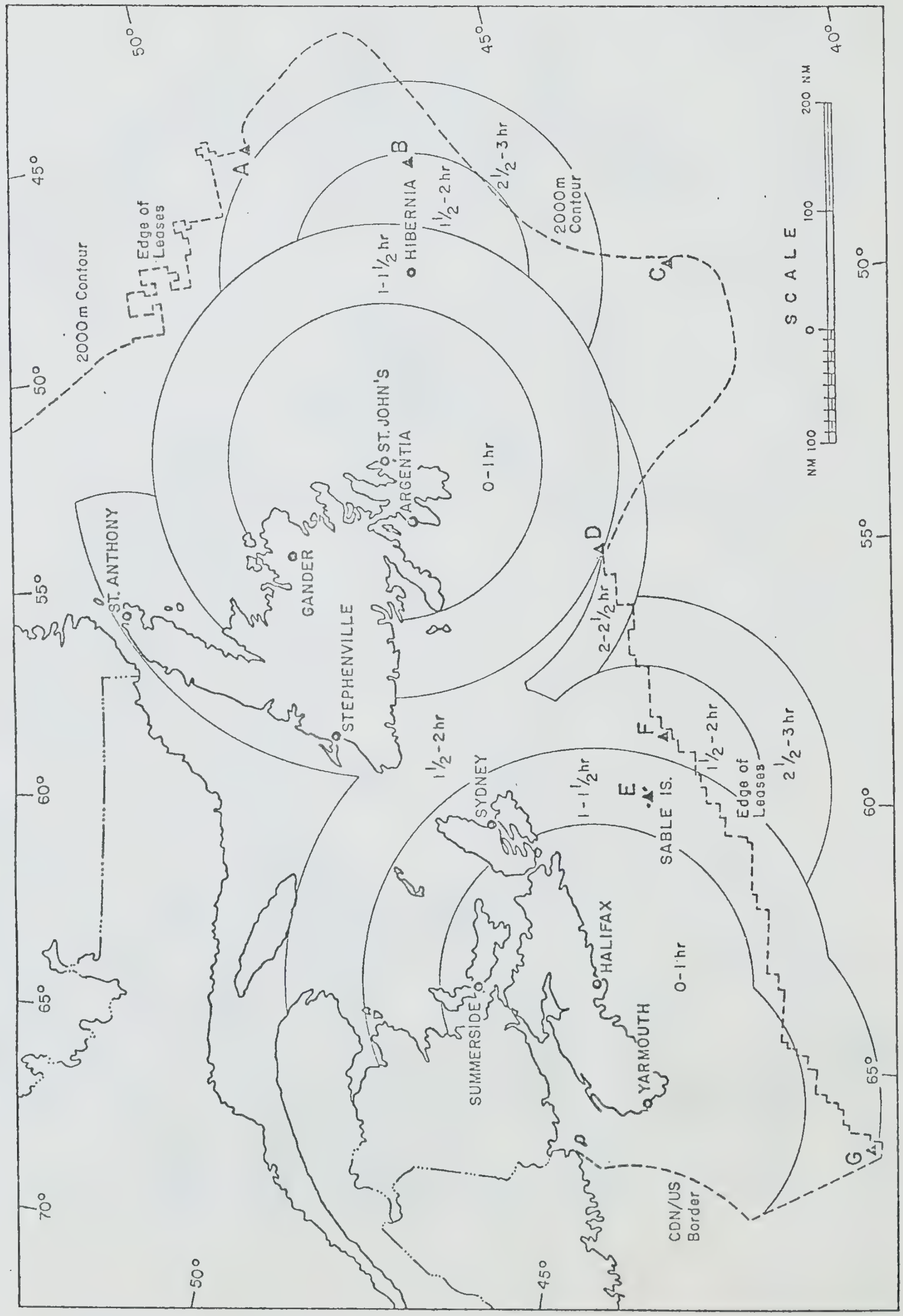
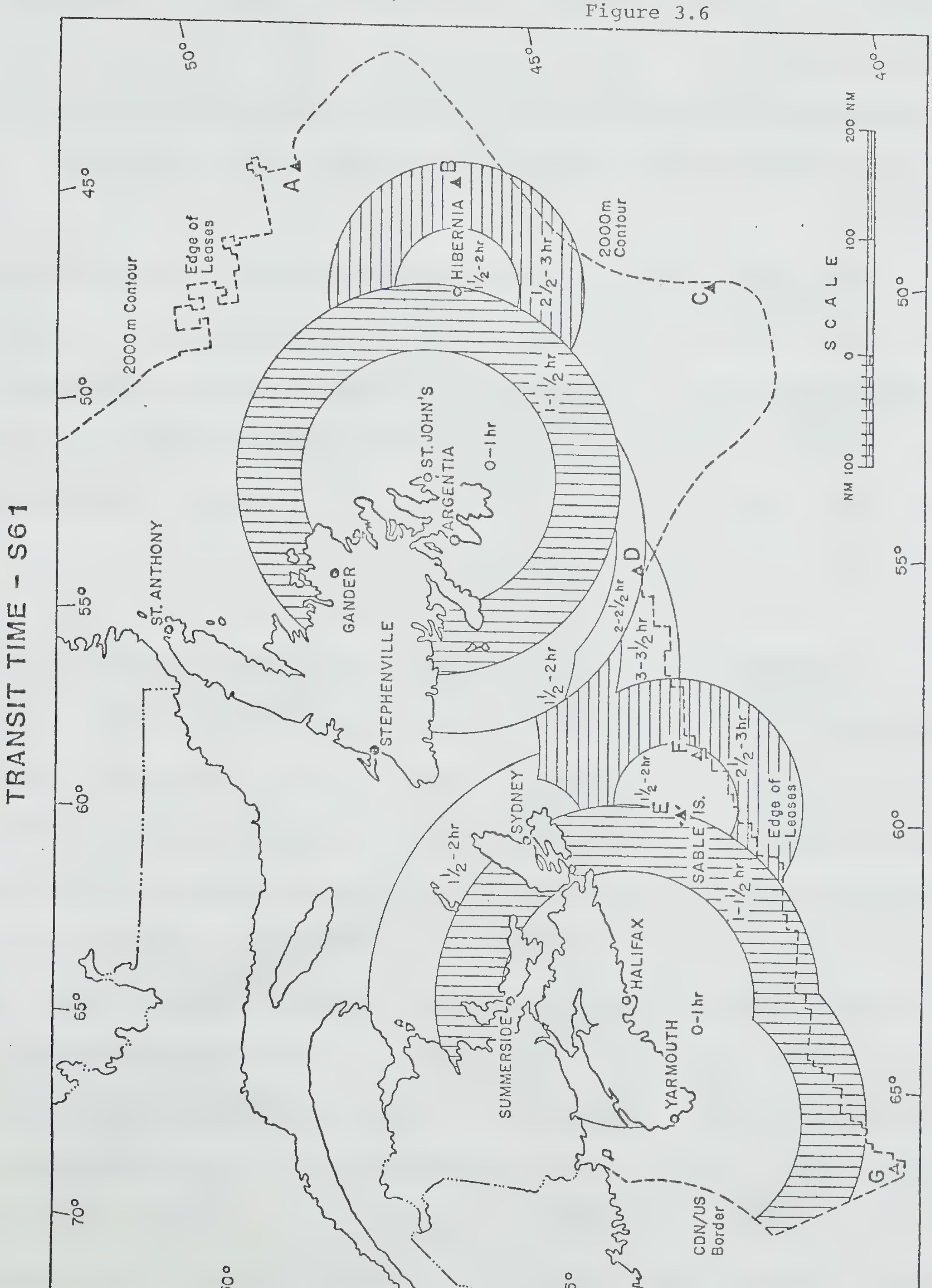


Figure 3.6


TRANSIT TIME - S61
ST. ANTHONY
GANDER
STEPHENVILLE
ST. JOHN'S
ARGENTIA
0-1hr
1-1½hr
HIBERNIA
1½-2hr
2½-3hr
2000m Contour
Edge of Leases
A
B
C
D
2-2½hr
3-3½hr
1½-2hr
SYDNEY
E
F
1½-2hr
2½-3hr
Edge of Leases
SABLE IS.
1-1½hr
1½-2hr
HALIFAX
0-1hr
YARMOUTH
SUMMERSIDE
G
CDN/US Border
SCALE
NM 100
0
100
200 NM
50°
45°
40°
55°
60°
65°
70°

The industry has available a number of dropable survival kits called Standby Emergency Assistance (SEA) kits. These are similar to the military MA-1 survival kit used by the SAR system. As with the MA-1 the survivors must be able to help themselves into the liferafts and the S.E.A. kit only brings the survivors into a less hostile environment than the sea.

Landing a helicopter on the deck is the quickest and most effective means of rescue for industry helicopters. As with the SARCUP helicopter, a landing will depend upon the degree of list and motion. The decision to attempt a landing under emergency conditions will probably be left to the aircraft commander and will depend upon the circumstances.

The S61N is the only industry helicopter capable of amphibious landings and these are restricted to calm conditions. As with the SARCUP helicopters this is not a commonly used technique due to the prevelent sea conditions in the study area and the excessive maintenance caused by landings in salt water.

The industry has available at several locations (St. John's, Halifax, on some of the rigs, and on some supply vessels) Emergency Multiple Person Rescue Apparatus (EMPRA) baskets. The EMPRA basket consists of an open top floatation ring and a rigid steel grating base connected together with high strength netting. The lifting cables lifts on the rigid base through the floatation ring to a single point which connects via a cable to

the helicopter's external hook. The EMPRA is designed to float flush with the water surface and is large enough to accommodate 15-20 persons.

In the case of survivors in the water, the helicopter would hover into position and lower the EMPRA basket into the water near the survivors. The sling cable would then be slacked off and the survivors would enter the basket over the floatation ring.

If survivors are not able to help themselves the helicopter may then trawl with the EMPRA and attempt to scoop up survivors in the water.

After survivors have entered the EMPRA the helicopter would then lift the basket out of the water and fly the survivors, suspended in the EMPRA from the cargo sling, to a rescue site.

The EMPRA basket offers the advantage of being able to pick up a large number of persons in a short time if they are capable of helping themselves into the basket and are grouped together. However, since the EMPRA basket must be attached to the aircraft externally prior to takeoff, it restricts the speed of the aircraft to about 90 knots.

Aircraft speed with survivors in the EMPRA basket is restricted to less than 50 knots.

The EMPRA basket also does not provide an immediate place of refuge for survivors. Since the survivors cannot be brought into the helicopter they will be exposed to the elements during the trip (at a speed of 30 to 50 knots) to the nearest rig or supply vessel. When ambient temperatures are low this exposure could be critical.

The industry S61 and Super Puma helicopters also have the capability to be fitted with hoists. Although not permanently installed the hoists are available at St. John's and Halifax and can be fitted in about 15 minutes.

The hoisting technique used by the industry utilizes a Billy Pugh type of net on the hoist line. This technique was described for the SAR helicopters in Section 2.4. The capability of industry helicopters to carry out a rescue using this equipment is the same as for SARCUP helicopters as are the limitations of the techniques.

The duty cycle of the hoist used on the S61 is somewhat limited. For a 90 foot hoist it has the following capabilities:

- 150lb load - 6 cycles in not less than 35 minutes followed by a 30 minute cooling
- 300lb load - 4 cycles in not less than 24 minutes followed by a 30 minute cooling
- 450lb load - 2 cycles in not less than 12 minutes followed by a 30 minute cooling

- 600lb load - 1 cycle in not less than 5 minutes followed by a 30 minute cooling

A typical survivor will weigh between 200 and 250lbs which would mean that only 4 to 5 survivors per hour could be rescued using this hoist.

The hoist on the Super Puma has a capability for 5 two-man hoists with no time limit followed by either a 30 minute cool down or a 5 minute cool down in flight at 80 knots or faster. Assuming the 5 minute inflight cool down, the rescue of 18 persons should take about 1 hour as with the SARCUP helicopter.

3.5 MARINE RESOURCES - STANDBY/SUPPLY VESSELS

3.5.1 Purpose and Duties of Standby Vessels

The purpose and duties of standby vessels are outlined in part in the COGLA regulations.

The COGLA regulations[46,48] state that a standby craft shall be provided for a drilling operation as a means of evacuating personnel from the drill site.

The COGLA regulations also specify that the standby vessel must have sufficient capacity and equipment to evacuate all persons from the drill site, must maintain open communications channels with the drilling unit, and must be prepared to conduct rescue operations when:

- the safety of personnel, the safety of the drilling unit or the safety of the well being drilled by that drilling unit is endangered or is likely to be endangered;
- there is a particular danger of a man falling overboard;
- a helicopter is landing or is taking off from the drilling unit;
- diving operations from the drilling unit are in progress; or
- when the drilling unit is threatened by ice.

The December 1983 COGLA Communique also specifies that standby vessels must maintain a distance of not more than one nautical mile or 20 minutes steaming time from the vessel and that the standby vessel should also be prepared to warn ships in transit of the presence of the drilling unit.

The purpose of standby vessels, based upon the COGLA regulations can be summaried as follows:

1) to assist in the rescue of personnel from the MODU it is standing by;
2) to accomodate all evacuated personnel from the MODU in an emergency;
3) to be prepared to rescue personnel who may be endangered due to operations on or in the immediate vicinity of the MODU; and
4) to assist the MODU in avoiding collisions with other vessels;

Hollibone Hilbert and Associates[49] listed two other purposes for standby vessels in the North Sea which although not specifically stated in the COGLA regulations are implied. These are:

5) to act as a reserve communications center in times of emergency; and
6) to act as a command center in times of emergency.

3.5.2 MODU Evacuation - Techniques and Requirements

One of the prime purposes of standby vessels is to provide a site to where personnel from a MODU can be evacuated and accomodated.

The evacuation of personnel from a MODU directly on to a standby vessel can be carried out in a variety of ways. These include crane transfer, helicopter transfer, patent high line transfer, and flexible or rigid bridging systems. Crane transfer and helicopter transfer are the only methods which currently can be used off the East Coast of Canada.

Crane Transfer

This method involves swinging the survivors in a personnel basket to the standby vessel's deck from the rig using the rig crane. This technique requires a high level of skill on the part of the crane operator and of the standby vessel master. The use of cranes is limited to winds of about 45 kts and while it is possible to operate cranes in more severe conditions the risk of injuring someone would increase dramatically. Although it is not possible to define limits to this type of operation, the overriding limitation would be the relative motion between the smaller standby vessel and the rig, and the ability of the standby vessel to maintain a position close to the rig.

This method requires an open area free from obstructions where the rescue basket can be landed and where crew members can steady the basket and assist the personnel to disembark. Radio communications between the crane operator, the rig and the rescue vessel are essential for this type of rescue.

The freeboard and trim of the rescue vessel should be such that the receiving area is dry.

Helicopter Transfer

This type of transfer is similar to a crane transfer except that a helicopter performs the lift. Personnel could be transported to the standby vessel using an EMPRA or similar basket attached to the helicopter's external hook. This type of rescue can be carried out under conditions which would preclude the helicopter from landing on the rig or the use of the rig crane (eg. listing of the rig, conditions where the standby vessel could not hold station near the rig).

As with a crane transfer, an open area, free from obstructions, is required on the standby vessel to land the survivors. Radio communications between the helicopter and the standby vessel are essential and the freeboard and trim of the standby vessel should be such that the recovery area is dry.

One of the advantages of the helicopter transfer over a crane transfer is that the standby vessel is not required to be stopped for a long period of time close to the rig, therefore reducing the risk of collision.

The helicopter transfer method, as with a crane transfer, is limited by wind. In high winds it may be difficult to land the EMPRA basket on the deck of the standby vessel. In addition, the motion of the standby vessel may also preclude the landing of the EMPRA basket.

3.5.3 Recovery from Life Craft - Techniques and Requirements

By law, all approved lifeboats on MODU's in Canada must be totally enclosed to ensure their self-righting capability, to prevent flooding and for protection against fire. The fact that lifeboats and liferafts are enclosed makes the rescue of persons in them more difficult.

Under many conditions it may be adviseable not to attempt to rescue persons from these craft if there is no immediate danger of loss of life, or if remaining in the life craft will improve the conditions of their recovery.

The standby vessel could assist by towing a liferaft or a lifeboat which no longer can operate under its own power, but the

decision to tow must be made based upon the individual circumstances. It may in fact be more dangerous to attempt to tow these craft than to leave them to their own means.

The standby vessel can also provide a lee for the life craft but must avoid making any hard physical contact with the craft.

Survivors from a life craft could be recovered using the standby vessel's crane to pick off survivors individually or in small groups using a rescue basket thus avoiding direct contact with the craft.

Personnel could also be transferred from the survival craft to the standby vessel's fast rescue craft and then to the standby vessel.

If a rescue directly from the survival craft to the standby vessel were to be attempted, it would probably require the survivors to exit the survival craft and board the standby vessel via scrambling nets. The survivors would probably require assistance in boarding the standby vessel and the risk of someone falling into the water would be high.

To facilitate the recovery of survivors from a lifecraft the standby vessel again must have the ability to manoeuvre under severe conditions. A low freeboard is desireable for the recovery

of persons using scramble nets so that the vessel crew are able to assist the survivors. The use of a crane and rescue net will require an open deck area to land the rescue net.

3.5.4 Recovery from the Water - Techniques and Requirements

The recovery of persons from the water can be carried out in two ways: recovery directly to the standby vessel, and recovery into the standby vessel's fast rescue craft.

Recovery Directly to the Standby Vessel

The environmental conditions prevalent off the East Coast of Canada make the recovery of persons from the water very difficult as the survivor will likely be suffering from the effects of cold and will have a limited capacity to help himself. It is therefore important to have an ability to provide assistance in boarding the vessel.

Survivors may be lifted directly from the water using some type of lifting device such as a rescue basket. A rescue basket deployed from a crane can be trawled at low speeds to scoop up survivors or may simply be deployed alongside and the survivor enters it by himself. Rescue basket include the EMPRA and the Bennex Rescue Basket.

As with the other rescue techniques discussed, it is important that the standby vessel have the ability to manoeuvre under severe conditions and that there be an open deck area to recover personnel from the basket. The motion of the vessel in rough seas will limit the ability to successfully deploy the basket near survivors and to trawl for survivors. The capability to carry out this type of rescue can be enhanced by the use of high speed or motion compensated cranes.

The recovery of persons directly from the water can also be carried out by bringing the standby vessel into close proximity to the survivor and assisting him on board via scramble nets or using devises such as man hooks or by physical assistance from a diver/swimmer.

One of the difficulties in this type of rescue is the displaced water from the standby vessel tending to push the survivor away from it or the heavy rolling of the standby vessel tending to suck the survivor under its hull. Therefore the rescue zone on a standby vessel should not be in the vicinity of screws or thrusters or where the hull overhangs the water.

Scramble nets are important in providing a handhold for survivors alongside the standby vessel and they should be allowed to stretch well into the sea so that they do not come clear when the vessel rolls.

As survivors will likely have only a limited ability to help themselves, it is important that there be a low freeboard in the rescue zone so that the vessel crew can assist survivors up the scramble nets or to pull survivors directly from the water onto the deck. A low freeboard, however, presents hazards in itself as it may result in a considerable amount of water being shipped in heavy weather. The optimum freeboard therefore must be the lowest which permits work on the deck in heavy weather and will depend largely upon ship design.

Manhooks and lifebuoys with lines can be used to assist in bringing survivors alongside the standby vessel but the vessel must have the ability to maneuver close to the survivors and to keep station while a rescue is in progress.

Recovery Using a Fast Rescue Craft

The use of fast rescue craft offers several advantages in the recovery of survivors from the water. These craft can reach survivors quickly, have a very low freeboard which makes it relatively easy to pull survivors on board, are very seaworthy and can operate in close proximity to the MODU where the standby vessel could not operate safely.

The effectiveness of these craft depends largely upon the ability to launch and recover them under extreme conditions.

Fast rescue craft are usually rigid or rigid bottom inflatables. They vary from 15 to over 35 feet in length and have speeds of up to 30kts.

The fast rescue craft can reach survivors much faster than the standby vessel and therefore can serve as an "extended arm" of the vessel. Once launched the fast rescue craft proceeds to the survivor where the rescue technique most commonly used is for the crew of the craft to turn the survivor with his back to the side of the craft and for two crew members to then lift the survivor into the boat, one lifting under each arm. The fast rescue craft then returns to the standby vessel where survivors can be transferred from the craft or where the craft can be recovered with the survivors in it.

3.5.5 Canadian Standby Vessels

The current practice in Eastern Canada is to use supply vessels as standby vessels. There are currently over 40 vessels available for oil industry related work in the Eastern Canada offshore. Table 3.1 outlines the particulars of vessels which were available in the spring of 1984. This listing may not represent all of the vessels currently available and may contain some vessels which are no longer in the region. However, it is indicative of the types of vessels commonly used by the oil industry for various types of work.

It should be noted that not all of these vessels have been or are currently being used as standby vessels as some are not equipped with rescue equipment. The vessels have been divided into three main categories: anchor handling/platform supply, platform supply and purpose converted standby/rescue vessels.

The anchor handling/platform supply vessels are characterized by a large open aft deck with an open stern to facilitate the deployment of MODU anchors. These vessels can be used for anchor handling, iceberg towing and for transporting cargo to and from the MODU's.

The platform supply vessels are of similar design to the anchor handling/platform supply vessels but do not have the open stern which is required for anchor handling or iceberg towing. These vessels are used almost exclusively for cargo transport to and from the MODU's.

The vessels listed as purpose converted standby/rescue vessels include two vessels which were converted from fishing trawlers and one converted sealer.

TABLE 3.1

CANADIAN STANDBY VESSELS

ANCHOR HANDLING/PLATFORM SUPPLY VESSELS

GROUP	NO. OF VESSELS	LENGTH (M)	NO. OF SCREWS	MAIN ENG. H.P.	THRUSTERS	THRUSTER H.P.	PROP CONTROL	FREE-BOARD	WINCHING AREA	SCRAMBLE NETS	RESCUE BASKET	MAN HOOKS	MOB	MOB LAUNCH	FRC	FRC LAUNCH
A	1	69.3	2VP Kort	12720	2 Bow 1 Stern	800 ea. 800	Joystick	.91	Aft Deck	2	Yes	4	-	-	1	Crane
B	3	67.4	2VP Kort	12240	2 Bow 1 Stern	800 ea. 800	Joystick	.97	Aft Deck	2	Yes	4	-	-	1	Crane
C	6	71.0	2VP Kort	11200	2 Bow 1 Stern	800 ea. 800	Joystick	1.09	Aft Deck	2	Yes	4	-	-	1	Crane
D	1	70.2	2VP Kort	9460	1 Bow	600	Bridge Control	.91	Aft Deck	2	No	5	-	-	1	Crane
E	2	60.2	2VP Kort	8640	1 Bow	600	Bridge Control	1.22	Aft Deck	2	No	4	-	-	1	Crane
F	1	63.9	2VP Kort	8480	1 Bow	400	Bridge Control	.79	Aft Deck	2	Yes	4	1	Crane	-	-
G	5	64.4	2 Kort	8160(2) 8000(3)	1 Bow	800	Joystick	2.21	Aft Deck	2	Yes	4	2(3)	Davit(3) Crane(1)	1(2)	Crane(1) Davit(1)
H	1	64.4	2VP Kort	7600	1 Bow	800	Joystick	2.21	Aft Deck	2	Yes	4	1	Miranda Davit	1	Miranda Davit
I	1	67.0	2VP Kort	7600	1 Bow	600	Bridge Control	1.72	Aft Deck	2	Yes	4	-	-	1	Crane
J	3	69.4	2VP	7200	1 Bow	800	Bridge Control	.94	Aft Deck	2	Yes	4	-	-	1	Crane
K	1	64.4	2 Kort	7040	1 Bow	560	Bridge Control	2.21	Aft Deck	2	No	4	-	-	-	-

TABLE 3.1 (cont'd)

CANADIAN STANDBY VESSELS

ANCHOR HANDLING/PLATFORM SUPPLY VESSELS

GROUP	NO. OF VESSELS	LENGTH (M)	NO. OF SCREWS	MAIN ENG. H.P.	THRUSTERS	THRUSTER H.P.	PROP CONTROL	FREE-BOARD	WINCHING AREA	SCRAMBLE NETS	RESCUE BASKET	MAN HOOKS	MOB	MOB LAUNCH	FRC	FRC LAUNCH
L	3	62.0	2VP Kort	6000	1 Bow	610	Bridge Control	1.45	Aft Deck	2	1 Vessel (a)	4	-	-	1(2) (a)	Crane(2) (a)
M	1	60.0	2VP Kort	6000	1 Bow	500	Bridge Control	.81	Aft Deck	2	No	4	-	-	-	-
N	1	56.1	2VP Kort	5280	1 Bow	570	Bridge Control	.64	Aft Deck	2	Yes	4	-	-	-	-

(a) One vessel has a rescue basket, crane and FRC
One vessel has a crane and FRC but no rescue basket
One vessel has none of these

TABLE 3.1 (cont'd)

CANADIAN STANDBY VESSELS

PLATFORM SUPPLY VESSELS

GROUP	NO. OF VESSELS	LENGTH (M)	NO. OF SCREWS	MAIN ENG. H.P.	THRUSTERS	THRUSTER H.P.	PROP CONTROL	FREE-BOARD	WINCHING AREA	SCRAMBLE NETS	RESCUE BASKET	MAN HOOKS	MOB	MOB LAUNCH	FRC	FRC LAUNCH
O	2	78.8	2VP	6000	2 Bow	600 ea.	DP	1.07 (b)	Aft	2	Yes	4	-	-	1	Crane
					2 Stern	300 ea.			Deck							
P	4	71.9	2VP	5480	2 Bow	600 ea. (3) 800 ea. (1)	DP	1.80	Aft	2	Yes	4	1(1) (c)	Miranda Davit(1) (c)	1(4) (c)	Crane(3) (c) Miranda Davit(1) (c)
					1 Stern	400 ea. (3) 800 ea. (1)			Deck							
Q	1	68.2	2VP	5400	2 Bow	800 ea.	Joystick	1.32 (b)	Aft	2	Yes	4	1	Crane	1	Crane
					2 Stern	800 ea.			Deck							

(b) Vessels have high sides

(c) 3 vessels have a rescue basket, FRC and crane
1 vessel has a rescue basket, FRC, MOB and davits

TABLE 3.1 (cont'd)

CANADIAN STANDBY VESSELS

CONVERTED RESCUE VESSELS

GROUP	NO. OF VESSELS	LENGTH (M)	NO. OF SCREWS	MAIN ENG. H.P.	THRUSTERS	THRUSTER H.P.	PROP CONTROL	FREE-BOARD	WINCHING AREA	SCRAMBLE NETS	RESCUE BASKET	MAN HOOKS	MOB	MOB LAUNCH	FRC	FRC LAUNCH
R	1	46.25	1	1950	1 Bow(d) 1 Stern	330 200	Joystick	Spec-ial Zone	Yes	2	Yes	4	-	-	1	Crane
S	1	56.0	2	2300	1 Bow(d) 1 Stern	900 600	Bridge Control	1.75	Yes	2	Yes	4	1	Davit	1	Crane
T	1	66.5	1CP	4500	1 Bow 1 Stern	600 600	Bridge Control	1.45	Yes	2	Yes	4	-	-	1	Crane

(d) Thruster is azimuthing

3.6 TRAINING

3.6.1 Air Personnel

The oil industry in St. John's and Halifax has contracted helicopters for crew transportation to and from the rigs. The personnel which fly these helicopters must meet the standards of the Department of Transport for their respective positions (pilot, co-pilot, etc.) as well as the standards of competence required by the helicopter companies by whom they are employed.

This study will not examine the basic training requirements for pilots or other positions but will concentrate only on the training required for rescue operations.

The helicopter companies in St. John's and Halifax have developed in-house programs to train their personnel in the use of EMPRA baskets and in the use of the hoist.

The programs were developed after consultation with SAR personnel who advised upon the training of personnel in the use of the hoist. As the use of the EMPRA basket is relatively new the helicopter companies developed their own programs based upon their experience in the use of EMPRA.

The helicopter companies indicate that 8 to 10 hours initial training is required for a crew to become competent in the use of the hoist and the EMPRA basket. This training is mainly inflight and includes the hoisting of persons from the water and recovery of persons from the water using an EMPRA basket.

Hoist training is normally carried out using a Billy Pugh type of basket on the hoist line and is carried out only in calm water conditions. The person in the water is required to enter the Billy Pugh net on his own.

Hoist training does not include sending someone down the hoist line to assist the survivor as this technique is not endorsed by the helicopter companies or by the oil companies by whom they are contracted. The amount of training required to become fully cognizant in this rescue technique would probably preclude the training of all industry crews in its use.

Training with the EMPRA basket is also carried out under calm water conditions and includes trawling with the EMPRA basket to scoop up survivors.

All of the helicopter companies have ongoing rescue training for their aircrew which includes practice in the deployment and use of the EMPRA basket and the use of the hoist. The oil companies have allocated a number of hours per month to the helicopter companies for which they will pay for inflight

training for rescue. The number of hours allocated varies between the oil companies and may be supplemented by the helicopter companies.

Since the operators provide the standby/rescue helicopter on a rotational basis with different helicopters and crews being designated at different times all of the industry helicopter crews must be trained in hoisting and in using the EMPRA basket.

The December 8, 1983 COGLA Commonique stated that "Operators on the Grand Banks have agreed to provide a full-time dedicated search and rescue helicopter, with a crew trained in its use. DND will assess the SAR programs of the operators on a continuing basis and will provide SAR training for industry personnel".

DND and the industry have held several meetings regarding search and rescue but DND has provided only a minimal amount of training to industry personnel. There does not appear to have been a formal assessment of the training of industry crews by DND.

3.6.2 Marine Personnel

Regulatory Requirements

The COGLA regulations do not specifically specify the training which is required for crews of standby vessels. The Canadian Oil and Gas Drilling regulations state that "Every operator shall ensure that every person employed in a drilling program receives instruction and training in respect of all

operations and safety procedures that that person may be required to carry out during the course of his duties during such employment."

The December 8, 1983 COGLA Communique further stated that "The crew of each standby vessel is to be competent in the use of all equipment and is to carry out practice drills on a regular basis."

There is therefore a requirement for training of standby vessel crews in rescue techniques and in the use of rescue equipment but the regulations are not clear as to the specific training required.

The Newfoundland and Labrador Petroleum Drilling regulations state the same training requirement as is stated in the Canadian Oil and Gas Drilling Regulations. In addition, the November, 1983 Requirements for Operators Proposing to Conduct Winter Drilling Operations on the Grand Banks of Newfoundland stated that "Adequate numbers of the standby vessel crews must receive specialized training in lifesaving techniques and the use of the rigid inflatable fast rescue craft, rescue backet and raft launch/recovery. Launch, use and recovery of the fast rescue craft should be practised whenever weather and sea conditions permit".

The NLPD regulations are somewhat clearer in stating the

requirements for training of standby vessel crews, in that training in the use of a fast rescue craft is specifically required.

Training of Standby Vessel Crews

The average crew of a standby vessel in Canada is 11 or 12 persons. Each vessel has 5 or 6 licensed personnel which means that about 50% of the crew has been certificated by the Department of Transport.

In order to receive a certificate, a person must have completed the MED II course, an outline of which is included in Section 2.7. The MED II course provides instruction in lifesaving appliances, firefighting, survival and rescue and includes the St. John's Ambulance First Aid Course. The MED II course has been a prerequisite for receiving a certificate for a number of years and therefore the majority of the licensed personnel will have taken it. Some of the supply vessel companies are also sending unlicensed personnel to the MED II course.

In addition to the requirement for MED II for all licensed personnel, a MED III certificate is now required as a prerequisite to receiving a Master Mariner's certificate.

MED III is a five day course which includes many of the same

topics as MED II but on a more advanced level. The course is divided into five topics; lifesaving, firefighting, ship handling and management, and Cardiac Pulmonary Recessitation (CPR). A description of the MED III course is included in Annex F.

The three members of each of the standby vessel crews who will man the fast rescue craft attend a course in handling these craft. Fast Rescue Craft courses are available from the College of Fisheries in Newfoundland and from Survival Systems Inc. in Nova Scotia. Both courses are four days in length but the College of Fisheries comprises 40 hours of instruction while the Survival Systems course is 32 hours. The main difference is that the College of Fisheries course includes CPR and a night exercise with the Fast Rescue craft.

Both courses are based upon the fast rescue craft courses developed in the U.K. and Norway and include instruction on the following:

- FRC launch and recovery
- FRC handling
- survivor recovery using an FRC
- transfer of survivors from the FRC to a vessel
- communications
- FRC auxilliary equipment
- survival equipment

Both courses require that personnel have a MED II certificate prior to attending. The outline for the Newfoundland FRC course is attached in Annex F.

A two day course called the Senior Officer - Emergency Management Forum has been recently introduced by the Petroleum Industry Training Service (PITS). This course is designed for the senior officers of supply vessels and is conducted in a forum environment. The forum discusses the emergency situations which may occur in the offshore industry and the roles and responsibilities of the supply vessels. The course discusses the roles of the oil company personnel, the rig personnel, industry helicopter personnel and the supply vessel personnel in emergencies. The role of outside agencies such as Canadian Coast Guard and the SAR (air) system are discussed as well as the medical aspects of emergencies. This course has only recently been introduced and therefore the officers of all the supply vessels have not yet attended.

The current levels of training for standby vessel crews can be summarized as follows:

- MED II is required as a prerequisite to taking the FRC course and for officer certification. Over 60% of the crew of most vessels will therefore have MED II.

- Over 60% of the crew of most vessels have first aid training as part of the MED II course.

- Most of the vessels have 3 persons per crew which are trained in the use of FRC.

- Fast Rescue Craft crews, which were trained at the College of Fisheries and Master Mariners who were certified after MED III became a requirement for a Master's ticket have had training in CPR.

- Some supply vessel officers have taken the PITS Senior Officer - Emergency Management Forum.

3.7 INDUSTRY SAR IN THE NORTH SEA

3.7.1 Sector Clubs

Industry SAR in the North Sea has been developed primarily to meet the demands of production operations. The oil industry in the North Sea is under the regulatory jurisdiction of several countries and although platforms may be in close proximity they may be separated by an international demarkation line.

The offshore petroleum industry in the North Sea has developed organizations called Sector Clubs whose purpose is to supply mutual aid to operators operating within the area of the Sector Club without regard to national boundaries.

There are currently six Sector Clubs with one operating company in each club appointed as the coordinator.

The Sector Clubs provide a pool of equipment, which is usually owned or contracted by the individual operators, which an operator can call upon to enhance his own resources. The Sector Clubs maintain an up-to-date listing of all installations, drilling units, support vessels, and specialist vessels in each Club. This information is disseminated to each operator in the Club as well as to other Sector Clubs.

Although the Sector Clubs are geared mainly to the evacuation of production platforms and the control of fires and other emergencies on production platforms, the resources of the Sector Clubs are available to the operators of exploration wells.

The specialist equipment available in each of the Sector Clubs is geared towards firefighting, blowout control and accomodating personnel who have evacuated from an installation.

The Sector Clubs in the North Sea are very similar to the Joint Alert Organizations which have been formed for the Grand Banks and Scotian Shelf although the arrangements have been more formalized and in some cases specialized equipment has been purchased.

3.7.2 North Sea SAR Plan

An International SAR Plan was prepared and adopted by the North Sea countries in 1983. In this plan the United Kingdom, Norway, Denmark, Germany, the Netherlands and the North Sea Oil Operators Associations agreed to assist one another in the event of a disaster.

This agreement formalizes what has been in practice for several years. It does not lessen the importance of the Sector Clubs, but reinforces their ability to call for assistance from

the appropriate authority if and when required.

3.7.3 Air Resources

The oil industry in the North Sea has a large number of helicopters at its disposal. Evacuations of production platforms and drilling rigs can therefore be carried out in very short time periods utilizing helicopters.

The installations in the North Sea are generally within the range of both the U.K. and Norwegian Government SAR helicopers. However, some industry helicopters may operate and be permanently located in each sector. For example, there are five Bell 212's operating in one area which may be fitted with hoists and tasked to SAR operations.

There does not appear to have been a great deal of emphasis placed upon developing a full SAR capability for industry helicopters in the North Sea particularly for exploration rigs. The helicopter SAR capability which does exist is centered around the production platforms. This may be due to the close proximity of the Government SAR helicopters which are available in the event of an emergency.

3.7.4 Marine Resources

As was noted earlier some large specialized vessels have

been constructed for use in the North Sea. Their prime functions tend to revolve around firefighting, blowout control, providing accomodations for personnel from an installation and in some cases functioning as a mobil forward contingency base.

Marine resources which are dedicated to search and rescue are the standby vessels which are assigned to installations. Section 3.5 discussed the specific requirements for standby vessels in the U.K. and Norway. Therefore the discussion here will be confined to the types of vessels in use.

The majority of the standby vessels operating in the North Sea are either fishing trawlers which have been converted or supply vessels which have been upgraded for standby duties. There are only seven purpose built standby vessels in existance at the present time, an example of which is the "Sentinal" class of vessels.

The majority of the standby vessels in the U.K. sector of the North Sea are converted fishing trawlers which have had rescue equipment installed. These vessels have very good seakeeping characteristics but have limited station keeping and manoeurvring capabilities.

Because of this limited station keeping and manoeuvring capability, many of these vessels are unable to operate at close

quarters to an installation due to the hazards of collision.

Hollibone Hibbert and Associates noted that U.K. operators contingency plans generally envisage that an installation would be evacuated first by helicopter, second by lifeboat, third by life raft and lastly by the standby vessel. They cite only one evacuation of an installation using a crane basket and this was to a supply vessel.

The basic philosophy in the use of trawlers as standby vessels appears to be that the vessel will rescue persons from the water or from lifeboats or liferafts once the installation has been successfully abandoned. Fast rescue craft are used to rescue persons from the water in close proximity to the installation and are used to increase the rescue capability of the vessel for persons in the water at some distance from the installation.

Standby vessels in the Norwegian sector of the North Sea are usually converted fishing vessels or upgraded supply vessels. The requirements for standby vessels in the Norwegian sector are somewhat different than in the U.K. sector. The Norwegians have regulations which outline the station keeping and manoeuvring ability for standby vessels. The Norwegians also require that a standby vessel must have an area to land a personnel basket which implies that there must be a capability to effect a transfer of

personnel from the installation directly to the standby vessel via the personnel basket. Norwegian standby vessels carry much of the same rescue equipment as those in the U.K. with some minor exceptions.

3.7.5 Training On and Manning of Standby Vessels

United Kingdom

Standby vessels in the U.K. sector of the North Sea which are certified for up to 100 survivors, are required to carry a minimum crew of six (Master, Mate, Chief Engineer, Second Engineer and 2 Deckhands)[52]. The minimum crew requirement rises with the number of suvivors that the vessel is certified for to a minimum crew of twelve for vessels certified for 251 to 300 suvivors.

United Kingdom regulations require that at least 50% of the crew of a standby vessel have completed a basic first-aid course.

Training in the operation of fast rescue boats is required for a minimum of three crew members for each of the fast rescue boats which is carried. The Robert Gordon's Institute of Technology and the Lowestoft College of Further Education offer 3 to 5 day courses in the operation of fast rescue boats[53]. Crew members are instructed on the design construction and maintenance

of fast rescue boats and are given practical instruction and experience in the safe handling of these craft.

United Kingdom regulations require that the entire crew should attend a basic sea survival course and a course in rescue procedures and the care of survivors (Rescue Ship Crewmember Course).

The Rescue Ship Crewmember Course is offered at the same institutions as the fast rescue boat course and is 5 days in length. The course provides instruction in personal survival techniques, the design and operation of various types of survival craft, helicopter operations, search and rescue procedures, SAR operation in large scale emergencies, rescue ship manoeuvring, use of fast rescue craft, recovery of persons from the water and care of survivors.

Most standby vessels have exercises in launching and recovering the fast rescue boat and man-overboard drills at least weekly.

Norway

Minimum crew size for Standby Vessels in Norway is stipulated by the Norwegian Maritime Directorate as authorized by the manning regulations at the time in question[54]. Manning

requirements differ with the size and type of vessel and the areas of operation.

Crews of Norwegian standby vessels are required to attend a basic sea survival course similar to that attended by platform or MODU crews.

The Norwegian regulations also state that the entire crew shall be trained in bringing survivors and injured onto the standby vessel but no information on the content of this course was available at the time of writing.

The entire crew of the standby vessel is required to have training in the operation of the man-overboard boat. This course is similar to the fast rescue boat course given in the U.K.

The entire crew must have attended a basic first aid course and at least two members of the crew must have attended an advanced first aid course.

The Norwegian regulations also require that at least three members of the crew have training in surface swimming and the use and maintenance of surface swimming gear. Again, no information on this course was available at the time of writing.

CHAPTER 4: ANALYSIS OF GOVERNMENT - INDUSTRY SAR

4.1 RESPONSIBILITIES AND OBJECTIVES

4.1.1 Government

Canada's international responsibilities for search and recue are defined by ICAO Annex 12 and SOLAS but the level of response for both air and marine requirements is vague. Under ICAO, Canada is required to provide measures of assistance to aircraft in distress out to 30°W in the Atlantic "as it may find practical" while under SOLAS marine response for SAR is only required "round the coasts". The term "round the coasts" has been interpreted by legal officers in External Affairs and the Department of Transport to be the 12 mile Territorial limit.

There is no requirement for any special level of service to be provided for either air or marine distress other than the statement that arrangements will be made for the rescue of persons in distress. This requirement can be met by providing a listening watch on a radio and a facility for coordinating resources of opportunity to effect a rescue.

The objective for the National SAR Program which was recommended by the Report on an Evaluation of Search and Rescue states that the program should "prevent the loss of life and injury through Search and Rescue alerting, responding and aiding activities ..." It further defines Canada's area of responsiblity to fulfill this objective to extend out to 30°W in the Atlantic.

The implied objectives developed by the Report state that the SAR Program should locate all missing aircraft, vessels, and personnel involved in distress incidents and should save the lives of all survivors of air and marine distress incidents.

These objectives imply a level of SAR service out to the boundary of Canada's area of responsibility (30°W and 145°W) that is equal to that on land. The Canadian SAR equipment has very limited capabilities to save lives out to these boundries. A CC115 Buffalo operating out of St. John's, Newfoundland has a radius of action of about 500 nm which limits its range to about 40°W and SARCUP helicopters can only operate about 225 nm offshore. The only air resource available which has the capability to reach the limits of the SAR boundry is the secondary air resource, the CP140 Aurora aircraft, which can drop some survival equipment.

The situation with marine resources is similar. CCG has four large ocean going primary SAR vessels which could provide service out to 30°W but these vessels normally patrol the coasts of Newfoundland and Nova Scotia. The closest marine resources available for this area are the vessels of the Department of Fisheries and Oceans which patrol the Grand Banks area.

Canada's capabilities to fulfill all of these objectives therefore appear to be limited to about the limits of continental shelf, which coincides roughly to the 200 mile economic limit.

The Study Team is of the opinion that the objectives of the system should be modified to reflect this capability. The objective could state: "To save the lives of survivors of air and marine distresses within Canada and the Canadian economic zone, and to coordinate life saving assistance for the saving of lives to the SAR limits of responsibility of 30°W and 145°W.

The implied objectives of the National SAR program and those of the DOT Marine Administration both state "to minimize loss of property, providing the availability of salvage services". The Study Team is of the opinion that the provision of a limited salvage service should not be an objective of the SAR Program. The mandate of the program is to save lives with the reduction property damage only to the extent that it assists this mandate.

It should be noted, that in the objectives for the National SAR Program and in the Departmental Objectives the level of response to rescue persons is not well defined. The program should develop objectives which would form a yardstick against which the effectiveness of the system can be measured. Such an objective could read:

> "To maintain an appropriate level of SAR response capability to ensure a high probability (<u> ? </u> %) of locating and rescuing persons in air and marine distress incidents".

There is equipment currently on the market which permits distress alerting and the location of aircraft, ships and in some cases people with almost 100% certainty. The equipping of ships and lifeboats with Emergency Position Indicating Radio Beacons (EPIRB's), of aircraft with Emergency Location Transmitters (ELT's) and of floatation gear with Personnel Locator Beacons (PLB's) would eliminate much of the time spent in the search phase and would greatly increase the probability of locating and rescuing survivors.

In terms of the offshore oil and gas industry, the SAR system encompasses drilling units, supply vessels and helicopters within its objectives. The areas of drilling operations fall within the SAR area of responsibility and as such the SAR system would provide a response to an incident involving the drilling industry in the same manner as for an incident involving a large fishing trawler. It is noteworthy that one of the objectives of the National SAR program states that the system will "save the lives of all survivors of air and marine distress incidents". The Study Team interprets this to mean that persons involved in these incidents must take appropriate action to ensure their own survival while awaiting rescue. In the case of an incident involving a MODU or supply vessel, this would mean that the SAR system accepts responsibility and will provide a level of service appropriate to rescue persons who have safely abandoned the drilling unit or supply vessel and who are aboard lifeboats

and life rafts. The SAR system does not accept responsibility for, or provide a level of service which will ensure that persons will be rescued prior to the need to abandon the vessel.

4.1.2 Industry

The industry through its own admission and through government regulation has accepted some of the responsibility for Search and Rescue in its operations.

Although equipment is provided to faciliate the emergency abandonment of MODU's and to survive while awaiting rescue the industry tends to focus on the evacuation of personnel before this becomes necessary. The industry accepts responsibility for the evacuation of personnel in the face of impending conditions by providing helicopters and a standby vessel for this purpose.

The industry, by providing a standby vessel, also accepts responsibility for the rescue of persons using marine resources following the loss of a MODU. However, there is not complete agreement as to the degree of responsibility which should be accepted for providing air resources for the rescue of personnel from the sea. A portion of the industry feels that this is the responsibility of the government SAR system as it is not felt to be appropriate to subject the industry helicopter crews to the additional risks and responsibilities inherent in conducting rescue operations.

Similarly the provision of air rescue resources to deal with incidents involving supply vessels and helicopters is not totally agreed upon.

The oil and gas industry does recognize a responsibility for the immediate alerting of the SAR system, as is evidenced in Alert Plans and Contingency Plans, and to assist the SAR system in the event of an emergency.

The overall attitude of the industry, in terms of search and rescue response, appears to be that the industry will alert the SAR system and provide an initial response but that the SAR system should then manage the rescue operations with the industry providing such resources as are required.

4.1.3 Conclusions

Government

1) Canada's SAR responsibilities include providing SAR services out to 30°W and 145°W but the SAR system has only a limited capability to provide service to these areas.
2) The expected levels of response to SAR incidents are not well defined in the SAR objectives.
3) The SAR Program regards offshore oil and gas activity in the same manner as it regards other offshore activities.
4) The SAR System expects persons involved in distress incidents to have available the means for survival until SAR resources arrive.

5) The SAR system includes the provision of limited salvage services in its objectives.

Industry

1) The oil and gas industry accepts responsibility for providing an initial response to incidents.
2) The oil and gas industry expects the SAR system to play a major role in distress incidents.
3) There is disagreement within the industry as to the level of responsibility which should be accepted for providing air rescue resources.
4) There is a reluctance on the part of industry and of some industry helicopter crews to accept the increased personal risk and responsibilities inherent in helicopter rescue operations.

4.1.4 Recommendations

1) Objectives should be developed for the National SAR program which define the SAR areas of responsibility and which indicate where life saving is possible and where only SAR coordination is possible.
2) Objectives should be developed for the National SAR program which will provide a yardstick against which the effectiveness of the system can be measured.
3) The provision of salvage services should not be included as an objective of the SAR program.

4) Industry and the SAR system must develop agreed upon responsibilities for responses to distress incidents involving MODU's, supply vessels and helicopters.

5) Industry must come to a consensus as to the level of responsibility which will be accepted for the provision of air rescue resources.

4.2 RESCUE MANAGEMENT

4.2.1 Government

The system currently in place to manage the government Search and Rescue program appears to provide an effective management structure. The concept of ICSAR supported by a Secretariat provides a central focus from which the objectives and requirements of the line departments can be coordinated. This central focus is essential to ensure that manpower and resources are not duplicated between departments and to ensure that the program meets its overall objectives.

The proposed strengthening of the ICSAR Secretariat will enhance the ability of the management system to provide this required central focus. It will also allow more detailed planning and analysis of overall SAR needs and objectives to take place.

Although the current management system appears to be effective, some potential conflicts of interest exist. The Chairman of ICSAR is a member of DND who is currently the Chief of Air Doctrine and Operations. In this position he is responsible to the Chief of Defence Staff for all proposals on aircraft procurement including SAR aircraft and bases. As the Chairman of ICSAR he is directly responsible to the Lead Minister for SAR. Under the existing funding structure the SAR program

must compete with the Department of National Defense for "B Base" funds within the Defence Envelope. Although the Chairman of ICSAR is directly responsible to the Lead Minister in his ICSAR role his responsibilities to the Chief of Defence Staff in his DND role could present a significant conflict of interest.

If the proposed changes in the funding structure for SAR are implemented the potential for this conflict will be decreased. Under the proposed structure the SAR "B Base" budget will represent a separate budget envelope. The competition for funds would therefore take place at a higher level in the approval process but some conflict may still exist.

The designation of the Minister of National Defence as the Lead Minister for Search and Rescue also presents a potential conflict of interest especially under the proposed funding structure. In this case the Minister of National Defence would be responsible for recommending both the Defence Envelope and the SAR Envelope budgets to the Foreign and Defense Policy Committee. The Report on an Evaluation of Search and Rescue recognized this potential conflict and recommended that a minister other than the Minister of National Defence be the Lead Minister for SAR. Similarly, if the Minister of Transport were the Lead Minister for SAR, a potential conflict of interest could arise.

The funding arrangements currently in place do not appear to

complement the SAR management system. The process of obtaining approval for SAR "A Base" budgets as a portion of the line department budget is not in keeping with the function of ICSAR which is to provide a central focus for the SAR program. In particular, capital funding for the replacement of existing resources which is carried out within the "A Base" budgets of the line departments does not allow ICSAR and the Secretariat to evaluate the need for the replacement of these resources or to examine alternative options which may be more suitable to the overall needs of the program.

The proposal to include "A Base" funds as a part of the overall SAR budget, administered by ICSAR, should alleviate this problem.

The regional management system within the RCC's appears to be adequate. The Shift Supervisor whether he be from DND or CCG, has at his disposal either an air controller or a marine controller. The respective controllers should be able to provide advice to the shift supervisor on air and marine matters respectively.

4.2.2 Industry

Joint Alert Plans and Contingency Plans

The Joint Alert Plans developed by the industry represent a significant improvement in the ability of the operators to

provide mutual assistance in the event of an emergency. The Operators Management Committee provides a central management structure during emergencies which should expedite the timely procurement of resources from all operators.

The cooperative agreements, such as the Emergency Resources Sharing Plan, and the Temporary Assignment Agreement are essential elements in the management of emergencies as they outline the terms and conditions under which resources are shared thus avoiding delays which should otherwise occur.

The Joint Ice Management System provides a common ice information base to all operators, thus allowing more effective planning to avoid emergency situations.

The Joint Alert Plans outline preset conditions under which an Alert must be declared. The purpose of declaring an Alert, even though no emergency situation exists, is to bring the company management to a higher state of preparedness should an emergency occur. No action beyond bring the management to a higher state of preparedness is required when an Alert is declared. The Joint Alert Plans outline the mangement response required to a Multi-Operator Alert and the contingency plans of the individual companies describe the procedures and responsibilities of the management of the concerned operator when a single operator alert is declared, but when no immediate action is required.

The requirement to declare an Alert under a set of preset conditions implies that the operation is about to enter a period of higher risk and that there is the potential for an emergency to occur. The requirements following the declaration of an Alert include bringing industry rescue resources to an advanced state of readiness and, more importantly, the notification of the SAR system that an Alert has been declared. The notification of the SAR system that an Alert has been declared is essential in ensuring that the system is prepared to cope with an emergency.

The Joint Alert Plans adequately describe the management system following the declaration of a Multi-Operator Alert. The Operators Management Committee, comprised of representatives of each operator, coordinates the responses to Multi-Operator Alerts. The purpose of having a representative from each operator on this Committee is to allow each representative to disseminate Committee decisions regarding the response to their respective organizations. However, the SAR system, which is a major sourcce of rescue resources is not represented on this Committee. The Emergency Resources Sharing Plan Contact Procedures (Fig. 3.1) indicate that resources will be requested from the SAR system before they are requested from other operators yet the SAR system is not represented on the Operators Management Committee. This representation is essential if all resources are to be coordinated effectively.

The contingency plans which are prepared to deal with emergencies appear to be adequate. The plans cover the gambit of credible emergency circumstances and provide sufficient detail for the personnel to know what action is required.

Vessel and Flight Watch

The procedure of reporting the positions of all supply vessels to Central Flight Following every four hours provides a sufficient degree of accuracy for rescue purposes. The controller at Central Flight Following receives the vessel's position, heading and speed in every report and therefore can calculate the vessel's position between reports, quite accurately should an emergency involving a helicopter occur.

Maintaining a common watch on all vessels on a continuous basis is not necessary in the opinion of the Study Group, as each company maintains its own 24-hour a day watch. The positions of other operators vessels can easily be obtained during the periods when Central Flight Following is not in Operation. Typically most of the vessels are either stationed at the rigs or in port, with the number of vessels in transit usually being quite small.

The communications facilities and alerting procedures used by the Central Flight Following Service provide the capability to quickly deal with a helicopter emergency. The practice of running a communications check between the three and ten minute

alerts ensures that the number of false alarms is kept to a minimum. The time period between the 10 minute alert phase where SAR and the industry rescue helicopters are alerted, and the 30 minute alert, where resources are actually dispatched, represents a reasonable time frame. Both SAR and industry helicopters will require a minimum of 20 minutes from the time of alerting to the time when they can take off simply to prepare for the flight.

Similarly, supply vessels in the area are only alerted to the situation at the 10 minute alert phase and are not required to be dispatched until the 30 minute alert phase. Since these vessels will already be underway they will require no preparation time and could be dispatched at the 10 minute alert phase. Given the limited survival times of persons in the water it would seem prudent to dispatch these vessels at the 10 minute alert phase.

Aircraft reporting frequency into Central Flight Following is currently based upon checkpoints which are 30 nm apart. While this system of reporting offers the advantage of not having to plot positions at every report it can result in time between reports to vary from about 10 minutes to as much as 25 minutes. Personnel at Central Flight Following indicate that, under normal conditions, helicopters can transit between checkpoints in about 15 minutes. The limited survival times of persons in the water dictate an immediate response to an emergency and therefore a reporting frequency of every 15 minutes as opposed to every 30 nm would be more appropriate.

4.2.3 Conclusions

1) The present Search and Rescue management structure is appropriate to the needs of the program insofar as ICSAR and the ICSAR Secretariat provide a central focus for the program management.

2) The appointment of DND personnel to the position of Chairman of ICSAR represents a potential conflict of interest due to the process of "B-Base" funding.

3) The appointment of the Minister of National Defence as the Lead Minister for Search and Rescue represents a potential conflict of interest due to the process of "B-Base" funding. A similar conflict would exist if the Lead Minister for SAR was the Minister of Transport.

4) The current process of "A-Base" funding for the SAR program is not compatible with the existing management structure.

5) The management system within the RCC's appears to be adequate.

6) Agreements and plans are in place which will enable the industry to effectively provide mutual assistance during emergencies.

7) The Operators Management Committee is an effective method of managing Multi-Operator Alerts. The SAR System is not represented on this Committee.

8) Company contingency plans are adequate in scope and detail.

9) The present arrangements for a vessel watch are adequate for the current activity.

10) Central Flight Following facilities and equipment are adequate to meet the current needs.

11) Procedures followed at Central Flight Following are adequate with the exception of the following:
    - supply vessels are only alerted at the 10 minute alert phase;
    - helicopter reporting is based upon position.

4.2.4 Recommendations

1) The existing SAR management structure should be maintained but the ICSAR Secretariat should be strengthened.

2) The Chairman of ICSAR should not be appointed from a SAR Line department.

3) A minister other than the Minister of National Defense or the Minister of Transport should be the Lead Minister for SAR.

4) The proposed funding model for SAR should be implemented to make the funding process compatible with the management structure.

5) The SAR system should be represented on the Operators Mangement Committee when SAR resources are utilized.

6) Supply vessels should be dispatched by Central Flight Following at the 10 minute Alert Phase.

7) Helicopter reporting to Central Flight Following should be based upon a 15 minute time interval.

4.3 RESOURCE DEPLOYMENT

4.3.1 Government

Section 2.5 reviewed the potential clients of the SAR system and the historical users of the system.

The offshore oil and gas industry does not represent a significant potential client population nationally as the numbers of persons and vessels involved in fishing, commercial shipping, and using the seas for recreation far exceeds the numbers involved in the oil and gas industry.

In the Halifax Search and Rescue region where the majority of the oil and gas activity is taking place, the offshore oil industry is a more significant potential client group but is still only a small portion of the total potential clients.

The oil industry historically has not been a major user of the SAR system nationally or in the Halifax Search and Rescue Region. The majority of the SAR incidents involve pleasure craft or fishing vessels with the oil industry being involved in only a small number of incidents.

The SAR system historically has provided a service to pleasure boaters, fishermen and commercial shipping for marine distress incidents. These continue to be the largest users of the

SAR system even though oil exploration activity has increased over the past few years. The deployment of SAR resources is therefore geared to meet the demands of these users. As the oil industry has not been a major user of the system historically and continues to be only a small user, resources have not been re-deployed or added to cope with the potential needs of this industry.

National Deployment of Air Resources

The discussion of the deployment of air resources between the four search and rescue regions in Section 2.6 indicates that the deployment of air resources in the Halifax region represents a level of service which is at least equal to that in the Trenton region and which exceeds that in the Victoria region. This does not mean that the Halifax region has air resources in excess of what is required. Some areas within the Halifax Search and Rescue region cannot be effectively serviced by the present resources (Labrador Coast, Grand Banks). Based upon historical incidents, however, the problems of providing effective SAR aircraft coverage with the existing resources is more severe in the Victoria region and at least as severe in the Trenton and Edmonton regions.

Therefore, if additional air resources were available to the SAR system, placing them in the Halifax region could not be

justified as other regions have a more immediate and a greater need for additional air resources.

Deployment of Air Resources in the Halifax Region

Section 2.6 outlined the possible locations for air resources in the Halifax region and concluded that the present deployment of helicopters in Gander and Summerside and of fixed wing aircraft in Summerside represents the optimum location for these resources to provide coverage for the majority of marine distress incidents.

However, these locations are not effective in providing a service to the oil industry. Oil industry activity is centered in areas which historically have had a low concentration of distress incidents. As such these areas tend to be on the fringes of the effective coverage.

Relocating SAR resources to St. John's and Halifax represents the optimum coverage for the oil industry but would represent a dramatic decrease in the level of service provided for incidents along the north and west coasts of Newfoundland and in the Gulf of St. Lawrence. Because these areas have experienced a much higher concentration of marine distress incidents than have the areas where the oil industry is operating, such a relocation of resources cannot be justified.

It is clear that the SAR system does not have sufficient air resources to provide an effective level of service to the oil industry and maintain the level of service provided to its other clients. Even if additional resources were made available to the SAR system the demands of other regions will overshadow the needs of the oil industry. Therefore, search and rescue air resources for the oil industry must be provided from a source other than the SAR system.

4.3.2. Conclusions

1) The oil industry represents only a minor potential client group for the SAR system.
2) The oil industry has historically been a very small user of the SAR system.
3) The deployment of air resources in the Halifax region represents a level of service equal to or greater than that in other search and rescue regions.
4) Other search and rescue regions will have priority over the Halifax region for any additional SAR air resources.
5) SAR air resources in the Halifax region are not well deployed to meet the potential needs of the oil industry but are well deployed to meet the overall SAR needs.
6) SAR air resources to meet the potential needs of the oil industry must be provided from outside the SAR system.

4.3.3 Recommendations

1) The deployment of SAR air resources in the Halifax region should be maintained at its present level.

2) Search and rescue air resources are needed for the oil industry. These should be obtained from outside of the SAR system.

4.4 AIR RESCUE

4.4.1 Operational Limits

Table 4.1 outlines the operational limits and the equipment carried by the SARCUP, Sea King, S61, and Super Puma helicopters.

The performance characteristics indicate that all four helicopters are in the medium lift category. The first three are circa 1960 designs and the Super Puma a late 1970's design, giving it a 15% speed advantage and a somewhat longer range.

Wind limits for rotor engagements and stopping may determine whether a helicopter may safely be started and ultimately launched on a mission. Of the four, the Sea King and the Super Puma are the least restricted by wind.

Although a great deal of engineering effort has been expended on anti-icing techniques for helicopters, no complete solution to this problem has been found, and as a rule of thumb, helicopters do not fly in icing conditions. However, tests conducted in France on the anti-icing equipment available for the Super Puma have resulted in this helicopter being authorized for flight into light icing conditions by the French authorities. The Department of Transport has not yet given this authorization in Canada.

TABLE 4.1

HELICOPTER PERFORMANCE, EQUIPMENT AND LIMITATIONS RELATING TO A TYPICAL RESCUE MISSION

CRITERIA	SARCUP	SEA KING	S-61N	SUPER PUMA
Performance				
1. En Route Speed	115K	115K	115K	135K
2. Endurance to Zero Fuel (1)	5h 33min Summerside 5h 12 min Gander (2)	4h 15min	5 hrs	5 hrs
3. Zero Wind Radius of action to Zero Fuel (1)	309nm Summerside 289nm Gander	234nm	277nm	326nm
4. Maximum Load (Passengers - PAX and Litters - LIT)	18 PAX or 6 LIT plus 10 PAX	12 PAX	18 PAX	14 PAX (C Model) 16 PAX (L Model)
Wind Limits				
5. Rotor Spread (3)				
Tail Rotor	N/A	40K	N/A	N/A
Main Rotor	N/A	45K	N/A	N/A

TABLE 4.1 (cont'd)

CRITERIA	SARCUP	SEA KING	S-61N	SUPER PUMA
6. Rotor Start/Stop	52K Steady (4) decreasing to 30K mean with 15K gust spread	60K within 45° of the nose, decreasing at other angles	45K	55K on the nose, decreasing at other angles
<u>Weather Limits (5)</u>				
7. Take Off - Land Base	200'/¼m	200'/¼m	100/¼m (6)	100'/¼m (6)
8. - Ship	N/A	200'/½m	N/A	N/A
9. - Rig	200'/½m	200'/½m	150'/½m	150'/½m
10. Icing	Helicopters are not permitted to fly into known icing. If icing is encountered, they are required to leave the icing zone.			
11. Landing - Land Base	200'/¼m	200'/¼m	200'/¼m	200'/¼m
12. - Ship	N/A	200'/½m	N/A	N/A
13. - Rig	200'/½m	200'/½m	150'/½m	150'/½m

TABLE 4.1 (cont'd)

CRITERIA	SARCUP	SEA KING	S-61N	SUPER PUMA
Rig Operating Limits (Emergency)				
14. Heave at Helideck	At Aircraft Commander's Discretion. No Limits Published.	At Aircraft Commander's Discretion. No Limits Published.	45'	30'
15. Pitch - Engine Running			10°	12°
16. - Shut Down			10°	10°
17. Roll - Engine Running	"	"	10°	8°
18. - Shut Down	"	"	10°	5°
19. List	"	"	10°	12°
Communications Equipment				
20. High Frequency (HF)	x	x	x	x
21. Very High Frequency AM (Vam)	x	x aircraft fitted	x	x
22. Very High Frequency FM (Vfm)	x	x with Vam or Vfm	x	x
23. Ultra High Frequency (UHF)	x	x		

TABLE 4.1 (cont'd)

CRITERIA	SARCUP	SEA KING	S-61N	SUPER PUMA
Navigation & Specialist Equipment				
24. OMEGA	x			x single unit;
25. VLF, ONTRAC 3			x A/C fitted	x uses dual signal input
26. LORAN			x VLF or LORAN	
27. RADIO COMPASS	x	x	x	x
28. VHF OMNIRANGE (VOR)	x		x	x
29. TACAN	x	x		
30. DISTANCE MEASURING EQUIP (DME)	x	x	x	x
31. TRANSPONDER	x	x	x	x
32. INSTRUMENT LANDING SYSTEM (ILS)	x	x	x	x
33. RADAR ALTIMETER	x	x	x	x
34. AIRBORNE RADAR	x	x	x	x
35. AIRBORNE RADAR BEACON MODE	x		x	x
36. DIRECTION FINDER	x	x	x	x
37. AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS)		x	x	x
38. DOPPLER RADAR		x		
39. SLING HOOK/EMPRA CAPABILITY	x	x	x	x
40. HOIST	x	x	may be fitted; limited duty cycle	may be fitted; limited duty cycle

TABLE 4.1 (cont'd)

NOTE 1: Endurance and radius of action for all four helicopters are calculated on the same basis for comparison purposes. They assume 10 minutes for start-up and taxi, but do not allow for final reserves which would vary, depending upon flight planning requirements, determined by weather, location, availability of alternates, etc.

NOTE 2: The version of the SARCUP helicopter based at Gander is the upgraded CH-113 Labrador which was procured in the early 1960's, in SAR configuration with large external fuel tanks. The version based at Summerside is the upgraded CH-113A Voyageur for which external tanks were procedured durin the "speedline" portion of SARCUP and were available only with an increased capacity.

NOTE 3: Limits apply to operation from a vessel at sea.

NOTE 4: Rotor start/stop wind limitation does not apply to Summerside, PEI, where helicopters may be started and shut down in an alert hangar.

NOTE 5: Weather limits are CEILING (measured in feet)/VISIBILITY (measured in miles). Land base take off and landing limits are based on airfield precision approach limits published by DOT and DND. Although these may vary between airfields, depending on the runway in use, the serviceability of approach aids and a number of other factors, these limits nevertheless provide a reasonable basis for comparison.

NOTE 6: Reduced take-off minima of 100'/$\frac{1}{4}$ are granted by DOT on application by an operator. This approval is provided following a review of company operations, pilots, aircraft and on-board equipment, in addition to approach aids available at the airport.

Weather limits for take off from land bases and for landing on rigs are higher for SARCUP and Sea King helicopters than for the industry S61 and Super Puma.

The industry helicopters can take off from land bases with a 100' ceiling and 1/4 mile visibility and can land on rigs with a 150' ceiling and 1/2 mile visibility. SARCUP and Sea King helicopters, however, must have a 200' ceiling for take off from land and for landing on rigs but the visibility requirements are the same.

Limits for landing at land bases are the same for all four helicopters (200', 1/4 mile).

The 100' ceiling and ¼ mile visibility limit for industry helicopters is a limit specially approved by Department of Transport for the individual helicopter companies based upon approach aids available, onboard flight equipment, type of helicopter and air crew training.

No approval for these lower limits for SARCUP or Sea King helicopters has been requested. The Sea King probably is capable of operations under these conditions but the SARCUP may not be due to its lack of an Automatic Flight Control System.

The industry helicopter companies publish limits of rig motion for landing while the SAR system (SARCUP) and Canadian

Forces (Sea King) leave this to the aircraft commander's discretion. The capabilities of these aircraft to land on a rig under severe conditions are about the same and will depend largely on pilot judgement.

Communications equipment on all four helicopters is comparable. Each has two-way radios covering the VHF aircraft band and the VHF marine band; these are limited to line of sight range, but are insensitive to much of the interference and to the propagation problems of lower frequency bands. The SARCUP and Sea King also carry UHF military aircraft band radios which are often useful, but not essential in an offshore rescue, in that they provide an extra communications channel between military aircraft. All four aircraft carry HF equipment, which is not limited to line of sight, but suffers from variable propagation; it is used mainly for long range communication with shore stations, rigs and ships, but also supplements VHF equipment at shorter ranges.

All four helicopters carry electronic equipment for both area navigation and point navigation. OMEGA and VLF both operate on very low frequencies and provide almost worldwide coverage; LORAN, operating at higher frequencies, provides navigation information only in an area where a ground transmitter chain is installed, such as the East Coast.

Point navigation relies on a single ground transmitter, usually close to an airfield, and provides aircraft with a bearing to/from the aid; equipment includes the ADF compass, VHF omnirange (VOR) and TACAN (military system). When these are sited with distance measuring equipment (DME), the bearing information obtained from VOR and TACAN stations can be upgraded into a fix.

The four helicopters have comparable navigation equipment and the absence of TACAN from the S-61 and Super Puma is not significant in a local transport or rescue role.

In addition to the point navigation aids which are also used during instrument approaches to air fields, all four helicopters carry instrument landing system (ILS), airborne radar (R) and a radar altimeter (RA). The first permits an approach for landing under adverse conditions of visibility and ceiling, the specific conditions depending on the runway in use and the ground equipment.

Airborne radar, whether used in conjunction with radar reflectors, a radar transponder beacon or merely a paint of the approach area, is not used as a primary approach aid in controlled air space, but may be used in other areas (e.g. vicinity of a rig) in conjunction with a procedure developed for the specific location.

A radar altimeter (RA) provides an indication of the height of the aircraft above the terrain or sea surface.

Direction Finding/Homing equipment consists of one or more indicators which show the direction of a radio transmitter (on the ground, in a ship or an aircraft) while it is transmitting. It is used in conjunction with one or more of the helicopter radio receivers. Although it may be used as an aid to navigation, military aircraft carry an elaborate DF system in order to localize other aircraft or ships.

The most commonly needed frequencies for the radio DF localization of an offshore rescue are in the VHF am (air) and fm (marine) bands, the most vital being the respective emergency frequencies. Both bands are covered by the SARCUP helicopter, half the Sea King fleet covers each band and the S-61N covers the emergency frequency in the VHF am (air) band. Neither band is covered by the Super Puma.

An Automatic Flight Control System, the modern term for an autopilot, provides hands-off control of a helicopter with varying degrees of automation at the pilot's discretion. For example, it may be coupled to a compass to maintain direction, to a pressure altimeter to maintain height or to a radar altimeter to maintain a fixed clearance above the terrain; it may also be coupled to a navigation aid, such as the ILS to fly an approach pattern in three dimensions automatically. In conjunction with a doppler radar it can enable the helicopter to hover automatically at a preselected height above ground or water without changing position (Auto-hover).

Two main advantages of the system are first, that it greatly reduces pilot concentration and fatigue since, unlike a fixed-wing aircraft, a helicopter is inherently unstable; this in turn permits a more accurate execution of manoeuvers. Secondly, when coupled to the doppler radar, it can perform Auto-hover under conditions of weather and seastate that might be impossible for a pilot to achieve visually. These two factors result in greater precision under almost all flight conditions and a significant improvement in the ability to perform a rescue at night and in poor weather.

The Sea King is fitted with an AFCS and a doppler radar giving it Auto-hover capability. The S-61 and Super Puma are fitted with AFCS, but do not have a doppler radar although it could be fitted to these aircraft. The SARCUP helicopter does not have an AFCS or a doppler radar. There is presently no AFCS for the SARCUP although one is under development by the U.S. Navy. However, it is not expected to be operational until 1987 and therefore Auto-hover for the SARCUP is at least 3 to 4 years in the future.

In comparing the four helicopters as rescue machines, one must examine the aircraft from two points of view:

- the capabilities inherent in the basic aircraft design, and
- the capabilities of the aircraft due to equipment which is added.

Basic Aircraft Design

The Sea King, S61 and Super Puma helicopters are all single rotor aircraft while the SARCUP is a twin rotor machine. The choice of a twin rotor machine by SAR was dictated by the overall demands which will be placed on the aircraft (landing in bush, mountain searches, etc.) in addition to marine rescues.

The twin-rotor aircraft offers better directional stability when obliged to perform rescues in gusty cross-wind conditions but this can be offset with auto hover on a single rotor aircraft.

Of the four aircraft, the Super Puma offers the highest speed, is the least restricted for flight planning by its single engine performance and the least restricted by wind for start up. Because of its higher speed the Super Puma also has the longest range of any of the aircraft.

Based only on aircraft performance the Super Puma is potentially the best overall rescue helicopter for the offshore industry of the four because of its speed and range. However, it may not be the best overall SAR helicopter when in other rescue situations such as mountain rescues for which the SARCUP helicopters are used.

The S61, Sea King and SARCUP are all about equal in terms of aircraft performance. All have the same cruising speed with the SARCUP and S61 having about the same range.

Aircraft Equipment

The equipment carried on each of the four aircraft is judged by the Study Group to be adequate with the exception of the following:

- SARCUP:
  - does not have an AFCS which will probably preclude its receiving approval for the lower take-off and landing limits currently approved for the S61 and Super Puma;
  - does not have an AFCS and doppler radar which would give it auto hover capability. This will not be available for 3-4 years.

- Sea King:
  - only one-half of the fleet has direction finding/homing equipment. This equipment is currently available.

- S61N:
  - does not have marine direction finding/homing equipment. This equipment is currently available;
  - does not have a doppler radar with its AFCS and therefore does not have auto hover capability. This equipment is currently available;
  - has an extremely limited duty hoist.

- Super Puma:
  - does not have marine or air direction finding/homing equipment. This equipment is currently available;
  - does not have a doppler radar with its AFCS and therefore does not have auto hover capability. This equipment is currently available.

Based upon the equipment currently installed on the four aircraft the Sea King is judged to be the best equipped helicopter for offshore rescue. However the S61 and Super Puma could be upgraded to an equivalent level.

The unavailability of an AFCS and doppler radar for the SARCUP helicopter restricts its rescue capabilities.

4.4.2 Response Times

The time for helicopters to reach the scene of an incident varies according to the helicopter in use and the time that the incident occurs.

Table 4.2 outlines the response times for each type of helicopter during daylight and off hours based upon the flying times developed in Figure 2.6 and Figures 3.4 to 3.6.

Points A and C will not be considered in this discussion as there is currently no activity in these areas. Although they are

TABLE 4.2

RESCUE HELICOPTER RESPONSE TIMES

	DAYLIGHT HOURS				OFF HOURS			
	S61	Super Puma	SARCUP	Sea King	S61	Super Puma	SARCUP	Sea King
Standby Posture	30 min St. John's 1 hr Halifax	30 min St. John's 1 hr Halifax	30 min	1 hr	1 hr	1 hr	2 hrs	1 hr
GRAND BANKS								
Point A		BEYOND IFR RANGE OF ALL HELICOPTERS						
Point B	3:15	3 hrs	4:15	N/A	3:45	3:30	5:45	N/A
Hibernia	2:00	1:45	3:30	N/A	2:30	2:15	5:00	N/A
Point C		BEYOND IFR RANGE OF ALL HELICOPTERS						
Point D	3:00	2:00	3:30	N/A	3:30	2:30	5:00	N/A
SCOTIAN SHELF								
Point E	2:30	2:15	2:30	2:30	2:30	2:15	4:00	2:30
Point F	2:50	2:40	3:20	2:50	2:50	2:40	4:50	2:50
Point G								
Helicopters in Halifax	Out of Range	3:30	4:30	Out of Range	Out of Range	3:30	6:00	Out of Range
Helicopters in Yarmouth	Out of Range	2:15	4:30	Out of Range	Out of Range	2:15	6:00	Out of Range

listed as being out of range of all helicopters in the figures and in the table, it may in fact be possible to reach these locations under certain conditions. The figures assume a 30-minute loiter time which reduces the normal range of helicopters as well as IFR flight conditions which because of its requirements for reserve fuel and alternate landing sites severely restricts the range.

In assessing the required response time for helicopters the roles that the helicopters would play in an incident must be examined.

The primary rescue roles of helicopters in offshore industry are:

- to evacuate persons from a MODU in light of predicted conditions which may endanger the safety of the MODU (land on board and ferry passengers ashore);
- to rescue persons from a MODU which is in any immediate danger of being lost and upon which it is no longer possible to land;
- to assist the standby vessel in rescuing persons from the water following the abandonment or loss of a MODU;
- to rescue persons from supply vessels in distress;
- to rescue persons following a helicopter ditching.

Planned Evacuation of a MODU

In order to evacuate all non-essential personnel (60 to 70 persons) from a MODU, four helicopter trips would be required. Using one helicopter the evacuation of personnel from a rig at Hibernia to St. John's would take about 16 hours while rigs operating on the edge of the Grand Banks would take several hours longer. The situation for rigs operating on the southern part of the Scotian Shelf where Sable Island cannot be used as an evacuation area is similar to Hibernia (16 hours). There is, in fact, more than one industry helicopter available for each rig on the Grand Banks and these can be supplemented by the SAR helicopters in Gander.

The conditions which require the calling of an Alert and the management system which has been put in place should ensure that sufficient time is available to evacuate rigs on the Grand Banks within the 12 to 18 hour time frame required.

The evacuation of rigs in the vicinity of Sable Island can be carried out in a much shorter time frame as the personnel could be evacuated to the contingency base on Sable Island.

Rescue of Persons from a MODU

The response capability required in order to rescue persons from a MODU which is in immediate danger will vary depending upon the circumstances but it is likely that the situation will

develop over a period of a few (3-4) hours. These situations could include incursion of ice within the safety zones, ballasting problems, or well control problems with the threat of blowout.

Table 4.2 outlines that industry helicopters can reach all areas on the Grand Banks within a four-hour time frame but that SARCUP helicopters require 5-6 hours to reach rigs on the Grand Banks and on the Scotian Shelf during non-operating hours. This difference in response capability between the industry and SAR helicopters is due to the location of the SAR helicopters and the two-hour standby posture maintained by SAR during off hours.

Rescue of Persons from the Water - MODU or Supply Vessel

The abandonment suits carried on MODUs and supply vessels are tested to prevent the onset of hypothermia for six hours. However, the tests do not take into account factors such as sea state, spray and physiological factors which can greatly reduce the survival time. Under ideal conditions (very calm seas) it is possible that survival would be possible for six hours but it is likely that it will be much less. In the case of a MODU the onus for rescue must therefore be on the standby vessel.

Industry helicopters can reach the scene within four hours, and assuming a theoretical survival time of six hours, could rescue survivors.

SARCUP helicopters will take 5-6 hours to reach locations on the Grand Banks and Southern Scotian Shelf during off hours. Although this is within the six-hour theoretical survival time it represents the upper limit of the time.

Rescue of Persons from a Helicopter Crash

The immersion suits worn by helicopter passengers offer less protection from hypothermia than the immersion suits used on rigs and supply vessels. The survival time for a person in a helicopter immersion suit is about 1½ hours during the winter in all parts of the study area. This situation is somewhat better in summer but for the purposes of this discussion the "worst case" has been assumed.

Both industry and SAR helicopters presently only have a limited capability to rescue persons following a helicopter ditching, assuming that they are unable to board a life raft and are in the water.

Helicopters report in to Central Flight Following an average of every 15 minutes. Therefore, 15 minutes could elaspe until Central Flight Following is aware that a helicopter is missing. A further 10 minutes is spent conducting a communications search for the helicopter for a total of 25 minutes from when the incident occurs to when the rescue helicopters are notified. The Study Group does not feel that this time can be practically

reduced. However, in most cases the helicopter should be able to send a distress signal in which case the alerting would be immediate.

Assuming an immediate alerting, industry helicopters based in St. John's could reach a site within one hour flying time (115-135nm) and helicopters based in Halifax within ½ hour fly time (55-65nm). This assumes a ½ hour standby in St. John's and 1 hour in Halifax.

In 1½ hours a supply vessel can transit about 20nm and a fast rescue craft about 35nm. The 1½ hour survival time is based upon the immersed multiplying factor developed for the Multifabs 430 helicopter suit (DCIEM MGNX suit) for the lowest mean sea temperature at each point during the year. The lowest mean sea temperature for each location was then reduced by 4°C to allow for yearly variations.

Obviously the mean water temperature varies at each location throughout the year and as a result the survival time varies correspondingly.

Table 4.3 outlines the survival time for each month of the year for a survivor in a Multifabs GNX 430 helicopter suit based upon a 2.15 Immersed Multiplying Factor and the Hypothermia Survival Model line of safety (Figure 1.2). These survival times

TABLE 4.3

SURVIVAL TIME IN A MULTIFAB GNX 430 HELICOPTER SUIT
(Based on Mean Sea Surface Temperature)

	A	B	Hibernia	C	D	E	F	G
January	1:45	1:45	1:40	2:05	1:45	1:52	1:52	2:20
February	1:43	1:41	1:37	1:55	1:40	1:45	1:45	2:05
March	1:43	1:41	1:37	1:52	1:40	1:43	1:43	2:05
April	1:45	1:43	1:37	1:58	1:43	1:47	1:47	2:12
May	1:52	1:52	1:43	2:12	1:52	1:58	1:58	2:28
June	2:00	2:00	1:52	2:32	2:33	2:24	2:24	3:26
July	2:24	2:28	2:24	3:48	3:05	3:26	3:26	6:00+
August	2:52	3:05	2:58	6:00+	4:47	6:00+	6:00+	6:00+
September	2:39	2:58	2:52	6:00+	4:08	4:47	4:47	6:00+
October	2:12	2:28	2:20	3:48	2:58	3:48	3:48	4:27
November	2:00	2:07	1:58	2:52	2:20	2:52	2:52	3:37
December	1:52	1:52	1:45	2:20	1:55	2:05	2:05	2:39
Low	1:43	1:41	1:37	1:52	1:40	1:43	1:43	2:05
High	2:52	3:05	2:58	6:00+	4:47	6:00+	6:00+	6:00+

are based upon mean sea surface temperature at each location and do not allow for yearly variations.

Obviously these times are only estimates but they do serve to roughly illustrate the potential for rescue following a helicopter crash.

A comparison of the response times of the four helicopters to the survival times illustrates that for SARCUP helicopters on ½ hour standby, rescue is possible during August and September at Point D, from June to November at Point E and from July to October at Points F and G. SARCUP helicopters have no rescue potential for survivors of a helicopter crash at points along the Grand Banks unless a crash occurs very close to shore.

An S61 on ½ hour standby in St. John's has a rescue potential for a helicopter crash at Hibernia from July to November and at Point D from July to October. An S61 on 1 hour standby in Halifax or Yarmouth has rescue potential from June to November at Points E and G and from July to October at Point F.

A Super Puma on ½ hour standby in St. John's has a rescue potential from July to October at Point B, from May to December at Hibernia, and from June to November at Point D.

A Super Puma on 1 hour standby in Halifax has a rescue potential from June to November at Point E, from July to November at Point F and from April to December at Point G (based in Yarmouth).

Table 4.4 illustrates that if the Multifabs 421 suit with a Wollybear Liner was used for helicopter commuting then the industry helicopters would have a rescue potential in all locations at all times of the year.

The obvious solution to the problem of rescue for helicopter passengers is to use the Multifabs 421 suit with a Woolybear liner. However, this suit has some severe limitations for use in a helicopter and therefore is not currently in use. A helicopter immersion suit which would provide thermal protection to survivors in 0°C water for four hours would provide an adequate degree of protection. A suit of this type has not yet been developed and therefore other measures must be taken to increase the chances of survival.

To ensure even a marginal rescue capability on the Grand Banks it is essential that a helicopter be available on 30-minute standby in St. John's at all times when industry helicopters are flying. The present practice of allowing the standby helicopter to transport passengers results in its reaction time being longer, in most instances, than if it were on shore. Although

TABLE 4.4

SURVIVAL TIME IN A MULTIFABS 421 WITH "WOLLYBEAR LINER" HELICOPTER SUIT
(Based on Mean Sea Surface Temperature)

	A	B	Hibernia	C	D	E	F	G
anuary	5:02	5:02	4:46	6:00+	5:02	5:21	5:21	6:00+
ebruary	4:56	4:51	4:38	5:30	4:46	5:02	5:02	6:00+
arch	4:56	4:51	4:38	5:21	4:46	4:56	4:56	6:00+
pril	5:02	4:56	4:38	5:39	4:56	5:08	5:08	6:00+
ay	5:21	5:21	4:56	6:00+	5:21	5:39	5:39	6:00+
une	5:48	5:48	5:21	6:00+	6:00+	6:00+	6:00+	6:00+
uly	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+
ugust	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+
eptember	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+
ctober	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+
ovember	5:48	6:00+	5:39	6:00+	6:00+	6:00+	6:00+	6:00+
ecember	5:21	5:21	5:02	6:00+	5:30	6:00+	6:00+	6:00+
ow	4:56	4:51	4:38	5:21	4:46	4:56	4:56	6:00+
igh	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+	6:00+

this would provide a rescue capability during the summer months, it will not be adequate for a helicopter crash near the rigs during the winter when survival times are reduced to as low as 1½ hours.

The only practical solution to this problem on the Grand Banks is the use of a suit which provides more thermal protection or the use of thermal clothing underneath the suit.

Rescue capability on the Scotian Shelf is also limited to the summer months but could be greatly enhanced if a helicopter were available on a 30 minute standby while helicopters are flying. A standby helicopter based on Sable Island during the winter months would provide an excellent rescue capability for this area. This could be achieved practically by having the first helicopter of the day being the designated rescue helicopter. It would fly out to the rig and discharge its passengers and return to Sable Island where it would remain on standby until the end of the day at which time it would return to Halifax.

4.4.3 Rescue Capabilities

Industry and SAR helicopters have three rescue techniques in common:

- dropping a survival package
- landing on a deck or in the water
- hoisting using a Billy Pugh Net

All three of these techniques suffer limitations in their ability to rescue personnel under certain conditions but provide a degree of rescue capability.

Survival Package

The MA-1 and S.E.A. survival kits offer a temporary refuge for persons in the water. These kits may become extremely important when there are large numbers of people in the water such as could follow structural failure on a MODU or a blowout with fire which could preclude an evacuation via lifeboats and life rafts.

Survival kits could be dropped to sustain survivors for a short time while helicopters and the standby vessel rescue other persons in the water.

Helicopter Landing

The technique of landing a helicopter in the water is one which is rarely used by the SAR system. Due to the prevailing sea state in the study area it has an extremely limited application and would probably not be used.

The industry and SAR helicopters have an equal capability to land on a deck and recover personnel. These limitations of this type of rescue are dictated by the motion and attitude of the deck and the decision to attempt this type of rescue would be the aircraft commanders.

Billy Pugh Type Net on a Hoist

This is the only hoisting technique used by industry and is used infrequently by SAR. For industry helicopters this is currently the best way to recover personnel from a deck if landing is not possible as it brings the survivors directly into the helicopter. As survivors on a deck should be capable of boarding the net and holding on while being hoisted, the rescue of survivors from a deck using the Billy Pugh net should be possible under all conditions that a helicopter can hover over the deck.

The use of the net to recover survivors from the water is more limited. As the net is quite small and in the case of the net used by SAR, can only be entered from one side, the survivor must be capable of entering the net without assistance. Even if the survivor is capable of helping himself it will be difficult to enter the net under extreme sea conditions.

The SARCUP, Sea King and Super Puma have an equal capability to perform a rescue using the Billy Pugh net on a hoist. The S61, as currently outfitted, has less capability because of the limited duty cycle of the hoist. If the S61 was fitted with a continuous duty hoist it would have an equal capability to the other helicopters. A minimum crew of four persons is needed for this type of rescue. A pilot, co-pilot, hoist operator and a man to help deploy the rescue basket.

EMPRA Basket

The industry helicopters utilize the EMPRA basket for rescue. Although the SARCUP and Sea King helicopters have the capability to use this equipment it is not currently in use. The SAR system is presently evaluating the use of the EMPRA basket.

The helicopter companies have run trials on the EMPRA basket. During the trails conducted by one company, using a dummy to simulate a survivor incapable of self-help, the dummy became entangled with the suspension lines and the operators assessed the situation as hazardous. In addition, a limitation was identified for cloud base, based upon the length of the suspension cable (90 ft.), the height of the helicopter above the sling hook (15 ft.) and any swell on the water. If, in addition, personnel have to be loaded or unloaded from a rig/vessel, then the height of the deck must be added in order that the aircraft remain clear of cloud. For these reasons, this helicopter company believes that EMPRA has potential in the area of emergency short range pick and shift, (for example, between rigs) but has serious reservation about the capability to trawl for survivors in the water, to transport personnel in low ceiling conditions and to successfully rescue potentially hypothermic survivors in cold weather.

There are other companies, on the other hand, who have performed initial trials with EMPRA and appear to have run into no major difficulties. Tests have, however, been performed in

only moderate seas and winds using subjects capable of self-help. All four of the helicopters presently have an equal capability to use an EMPRA basket.

Hoisting Using a Horsecollar

Hoisting of survivors using a horsecollar is only used by the SAR helicopters (SARCUP and Sea King). In using this technique as was outlined in Section 2.4 it is necessary to have a rescue technician descend down the hoist to assist the survivor into the horsecollar, particularly if the survivor is wearing an immersion suit.

Industry helicopter operators all agree that the prerequisites for successfully using this technique are as follows:

1. Permanently fitted or quick fit hoist with continuous duty cycle;
2. Minimum crew of four: pilot, copilot, hoist operator and rescue man;
3. Rescue man trained as diver and equipped for diving;
4. Crew trained in rescue techniques and with regular proficiency training; and
5. Adequate lighting for night rescue.

The SARCUP helicopter carries a crew of 5 (pilot, copilot, flight engineer/hoist operator, 2 SAR technicians) and two hoists; it does not have an AFCS, consequently it is incapable of auto hover. The equipment duty cycle is continuous and permits 2 man hoists. Frequently, one SAR TECH goes down the hoist to assist survivors, while the other remains in the helicopter to manage the survivors and assist the flight engineer. The Sea King carries a crew of 4 (pilot, copilot, systems operator, technician/hoist operator). The systems operator will go down the hoist to assist survivors when necessary, leaving the hoist operator to manage survivors in the aircraft. The Sea King has an AFCS with auto hover and is capable of operating and performing rescues in very low conditions of ceiling and visibility (Table 4.1). Hoist procedures in current use (horse collar or harness with single point suspension) maintain a survivor in the vertical position. In conjunction with the sudden removal of hydrostatic support on leaving the water, this places a considerable load on the cardio vascular system which may prove fatal in conjunction with a hypothermic condition.

Comparison of Rescue Techniques

The most effective overall rescue procedure is hoisting using a horsecollar and a rescue technician. Although slower than some of the other techniques it is possible to rescue survivors from the water who are not capable of self help. In the opinion of the study group this is the only technique which has the

capability of rescuing incapacitated persons from the water under extreme sea conditions.

The use of a rescue net on a hoist is the best alternative to using a horsecollar and rescue technicians. It is rarely used by SAR as they have the capability to use the horsecollar and SARTECH and feel that it is more effective. Given the present state of training of industry helicopter crews the Study Group considers that the net on the hoist should be the preferred rescue technique employed by industry. It allows rescue of survivors in the water if they are capable of self help and when the survivors are dispersed.

Hoisting using a net is also a very effective means of rescuing survivors from a deck when landing is not possible. The use of a two-man net would be faster than hoisting with a horsecollar and can be carried out under quite severe conditions.

The study group is of the opinion that the EMPRA basket is a good rescue tool in certain situations but does not have the versatility of the hoisting techniques. The major use for the EMPRA basket is felt to be:

- Rescue of survivors form a deck when they have to be transported only a very short distance;
- Rescue of survivors from the water when they are grouped together and are capable of self help.

If survivors from the deck of a ship or a MODU only have to be transported a very short distance the EMPRA May be a faster and more effective means of rescue than either hoisting technique. However, if transiting distances are long and the ambient temperature is low the survivors will be in considerable danger from exposure to the elements.

For the rescue of survivors from the water which are grouped together and are capable of entering the basket the EMPRA basket may again be a faster and more effective means of rescue than either hoisting technique. However this will only be the case when the sea state is not severe and when survivors only have to be transported a short distance.

The decision between hoisting with a two-man net or using an EMPRA basket will be largely dependent upon the distance that survivors must be transported. The EMPRA basket is easier for a survivor to enter in the water than the two-man net but with the EMPRA survivors cannot be brought into the helicopter. If survivors are dispersed it would therefore be necessary to recover 1 or 2 persons at a time and ferry them to a nearby place of refuge. In this instance either hoisting technique would be faster.

The reduced airspeed which is required while transporting the EMPRA basket precludes, in the opinion of the Study Group,

transporting it from shore to the scene of an MODU incident which is a distance offshore. The time lost in transit would be better spent on-scene hoisting using a horsecollar or a two-man net. As the primary role of the EMPRA basket is seen to be short range pick and shift operations these baskets should be available on MODUs.

4.4.4 Training of Air Personnel

The training of the personnel who operate the SARCUP helicopters is quite extensive and exceeds that of the industry helicopter personnel. In the opinion of the Study Group the training received by SAR personnel for helicopter rescue is adequate.

The initial training received by industry helicopter personnel is also judged to be adequate but only for the rescue techniques which are currently in use, i.e. landing on a rig, using an EMPRA basket, hoisting using a two-man net. It is important however that on-going training be provided for helicopter crews in these techniques as well as simulated exercises to develop an overall proficiency in managing a rescue. The input of the SAR system in the training of industry helicopter crews appears to have been minimal. The SAR personnel have extensive experience in hoisting techniques and this experience should be made available to industry on an on-going basis.

Industry crews are currently not trained to use a horsecollar and rescue technician for hoisting. This technique will require extensive training of the entire air crew and particularly of a rescue technician. The only source of training in Canada for this type of rescue is the SAR system.

4.4.5 Summary

Although the industry has developed some rescue capability, the present arrangements for providing a dedicated standby rescue helicopter in St. John's are not condusive to the development of an effective rescue capability.

1) The present practice of providing a standby/rescue helicopter on a rotational basis presents three serious drawbacks:
   - the helicopters are outfitted with only the minimum equipment required for rescue (i.e. hoists) as outfitting all of the helicopters with all of the equipment needed for search and rescue would be extremely expensive;
   - all of the helicopter crews must be trained in rescue techniques which does not permit the extensive training which is given to SAR crews; and
   - the standby rescue function severely restricts the capabilities of some operators to carry out crew transportation functions.

2) The oil companies, helicopter companies and some of the flight crews are concerned about the increased risk and possible legal implications which can result from rescue operations and are extremely reluctant to expose themselves to these.

3) The arrangements for providing the standby/rescue helicopter must be re-negotiated each time a new operator begins work in the area or when an existing operator leaves the area. As a result, the training time which is financed by the operators will vary according to the number of companies in the area.

4) The various operators have different policies as to the types of training which will be financed. Some operators finance training in both hoisting and the EMPRA basket while others do not finance training for hoisting.

4.4.6 Conclusions

Operational Limits

1) The Super Puma has the best characteristics for offshore rescue of the four helicopters examined.

2) The Sea King, because of its auto hover capability, is the best equipped helicopter for offshore rescue of the four helicopters examined.

3) The rescue capability of the Super Puma and S61 can be enhanced through the addition of auto hover and direction finding/homing equipment;

4) The SARCUP helicopter will not have auto hover capability for 3-4 years;

Response Times

5) The response time of industry helicopters is adequate for most incidents but is not adequate at all times to rescue persons following a helicopter ditching;

6) The response times of SARCUP helicopters during off hours are only marginally adequate to rescue persons from the water following an incident involving a MODU or a supply vessel. This is due to their location in Gander and Summerside and their two-hour standby posture;

7) The response times of SARCUP helicopters are inadequate to rescue persons following a helicopter ditching on the Grand Banks. This is due to their location in Gander and Summerside;

8) Helicopter immersion suits which provide protection from hypothermia for at least 3-4 hours are needed;

9) A dedicated standby helicopter which is on 30-minute standby when helicopters are flying is needed in St. John's throughout the year;

10) A dedicated standby helicopter which is on 30-minute standby when helicopters are flying is needed for the Scotian Shelf during the winter months. This helicopter should be based on Sable Island;

11) A dedicated standby helicopter which is on 30 minute standby when helicopters are flying is needed for the coast of Labrador during the summer months when drilling is taking place in this area.

Rescue Capabilities

12) The best method of recovering survivors from the water under adverse conditions is hoisting using a horse collar and a rescue technician. Only the SAR system uses this technique;

13) Industry capability to rescue persons from the water is limited to survivors who can help themselves and to moderate sea conditions;

14) Industry has the capability to rescue persons from the deck of a MODU or a supply vessel under adverse conditions;

15) The use of the EMPRA basket is restricted to short haul pick and shift operations;

Training

16) Industry crews are adequately trained in the rescue techniques which they presently use;

17) Industry crews are not trained to use a hoist with a horsecollar and rescue technician;

18) The SAR system has the capability and experience to provide training to industry crews but has not yet done so.

4.4.7 Recommendations

General

1) A single dedicated standby/rescue helicopter should be provided:
   - throughout the year in St. John's for the Grand Banks area;
   - during the winter months at Sable Island; and
   - during the summer months on the Coast of Labrador.

2) The standby/rescue helicopters should be equipped with a continuous duty hoist, auto hover capability and direction finding/homing capability in addition to the equipment presently on the industry helicopters.

3) The standby/rescue helicopters should have permanently assigned crews of at least four persons (pilot, co-pilot, hoist operator, rescue technician).

4) The standby/rescue helicopter crews should be trained in rescue techniques including:
   - hoisting using a horsecollar and a rescue technician;
   - hoisting using a rescue basket; and

- using the EMPRA basket.

5) The standby/rescue helicopter for each area should be a single helicopter contracted for and dedicated to this task and not a helicopter selected on a rotational basis.

6) The responsibility for contracting and administering the dedicated standby/rescue helicopter should be with the appropriate agency of the Government of Canada. This would have the following advantages over the present system:
   - a consistent level of training could be developed for personnel as the Government of Canada already has at its disposal the expertise and manpower to provide this training;
   - a consistent policy on rescue techniques could be developed;
   - industry concerns over liability and personal risk would be eliminated; and
   - resources could be re-distributed to react to changing patterns of activity. For example, one helicopter could be contracted to provide services for the Sable Island area in winter and then moved to the Labrador coast in summer.

7) SAR personnel should provide the training for the dedicated standby/rescue helicopter crews.

8) The dedicated standby/rescue helicopters should be funded by the oil industry.

9) Auto-hover capability should be incorporated into SARCUP

helicopters as soon as the necessary equipment becomes available.

9) The standby posture for SARCUP helicopters in Gander and Summerside should be reduced to 1 hour during non-working hours. This would greatly increase their potential to rescue persons from the water.

10) The Government of Canada and the oil industry should actively pursue the development of helicopter immersion suits which provide protection from hypothermia for at least three to four hours in all water temperatures.

11) Industry helicopters and crews which are used only for crew transportation should continue to train in the use of the EMPRA baskets.

4.5 MARINE RESCUE

The marine resources available to the oil industry off Eastern Canada are the standby vessels which attend each MODU. The four large SAR vessels operated by the Canadian Coast Guard may also be called upon to assist in a rescue but it is unlikely that they will be close enough to render immediate assistance.

This chapter will discuss the design considerations which should be considered for rescue vessels as well as the equipment which is required to effectively perform a rescue.

The vessels currently in use off Eastern Canada and the CCG primary SAR vessels will then be examined in light of these design considerations and equipment requirements.

4.5.1 Standby/Rescue Vessel Characteristics Desireable for Canadian Waters

The suitability of a vessel to perform rescue operations depends upon the design of the vessel and upon the equipment which is placed on the vessel. Section 3.5 discussed the operations which a standby vessel may be expected to carry out and noted the design considerations for these operations. The design considerations for a standby vessel include:

- dimensions
- stability
- construction
- seakeeping
- station keeping and manoeuvreability
- visibility
- rescue zone characteristics
- survivor accomodation
- towing
- survivor transfer area

When considering the design of a vessel for rescue operations the experience of other jurisdictions provides a valuable source of information. The U.S. does not require a standby vessel to attend offshore installations in waters under its jurisdiction, however the U.K. and Norway both require standby vessels. The regulations and guidelines in place in the U.K. and Norway therefore can provide a valuable insight.

Another source of information is the number of studies which have been carried out on standby vessels. One of the most comprehensive of these is a study carried out by Hollibone Hibbert and Associates[49] for the U.S. Department of Energy.

The design considerations listed above will be discussed in more detail with reference to the U.K. and Norwegian regulations and the relevent studies.

Dimensions

The dimensions of a vessel govern its motion characteristics under severe conditions to a large extent, although devices such as bulbous bows, full lines fore and aft and passive stabalization tanks can improve the motion characteristics of smaller vessels.

The dimensions also affect the manoeuvreing capability of the vessel and the power required to effectively manoeuvre or to keep station.

Purpose built standby vessels for various reasons tend to be about 50 meters in length but there are many standby vessels in operation in the North Sea which are less.

The U.K. regulations outline the minimum permissable length for standby vessels based upon the area of the North Sea in which they will be operated and the time of year. Allowable lengths vary from 23.15 meters in the southern portion of the North Sea to 31.85 meters for winter operations in the northern North Sea.

Hollobone Hibbert and Associates noted that vessels with a length of under 37 meters were unsuitable for operations under severe conditions in the northern North Sea.

The Norwegian regulations do not divide the North Sea into sectors for the purpose of specifying a minimum standby vessel length. The Norwegians specify a minimum length of 40 meters for standby vessels in their waters.

The environmental conditions experienced off the East Coast of Canada, particularly in winter, are as severe as those experienced in the northern North Sea. A minimum length of about 40 meters for standby vessels operating off Eastern Canada would therefore appear reasonable.

Stability

Government regulations and classification society rules lay down standards of stability to be achieved for all vessels. These standards include stability in the intact and damaged condition with allowances being made for water permeation of deck cargo. In Canada, extra limitations and conditions are placed on a vessel for the effects of icing.

An in-depth discussion of stability criteria is beyond the scope of this study and the regulations of the Flag States and the rules of the classification societies have been assumed to be adequate.

Construction

The construction of vessels is again carried out in accordance with government regulation and classification society standards and as such are assumed to be adequate.

Standby vessels off the East Coast of Canada, particularilly on the Grand Banks and off the Labrador Coast, often operate in conditions which sea ice can be present. Vessels operating in areas where ice is a possibility should be constructed to attain the Canadian ice class for the area of operation.

Seakeeping

Seakeeping is extremely important in carrying out rescue operations. None of the jurisdictions specify seakeeping abilities beyond stating that the vessel must be capable of carrying out its duties under all conditions.

Consideration should be given to minimize heave, pitch, roll, yaw and pounding. Exposed working areas should be kept as free of water as possible. These factors can be achieved or upgraded in a variety of ways.

The seakeeping characteristics of a vessel which is to be used for standby duties should be evaluated on an individual basis.

Station Keeping and Manoeuverability

The ability of a standby vessel to keep station and to manoeuvre is very important in rescue operations. The vessel may be required to keep station for extended periods of time during evacuations from a MODU or during helicopter winching operations. The ability to manoeuvre close to survivors is also extremely important.

Station keeping and maneurvering ability depend largely upon the configuration of various propulsion systems and the power available to each system.

Machinery available for station keeping includes: single screw propulsion, twin screw propulsion, bow thrusters, stern thrusters, azimuth thrusters and the vessel's rudder(s).

The simplest manoeuvreing system, a single screw and rudder, provides mainly longitudinal thrust with very limited lateral thrust. This system does not provide any redundancy in the event of a failure of the propulsion system and is not regarded as acceptable for standby vessels in Canada.

The Norwegian regulations require at least two independent means of propulsion so arranged that if one stops the other can still be used to manoeuvre the vessel. Hollobone Hibbert and

Associates also noted that it is desirable to have two sources of propulsion but this is not currently required under the U.K. regulations.

The most common method of providing two sources of propulsion is to have independently powered twin screws. These provide a greater degree of lateral movement, in that the stern can be moved laterally by contra-rotation of the propellors. The inside propellor maintains the longitudinal station while the ouside propellor and its rudder give lateral thrust. The bow can be given lateral thrust by opposite thrust and contra-rotation.

The power required for manoeuvering and station keeping using only twin screws depends largely upon the dimensions and displacement of the vessel. Large amounts of power would be required to provide sufficient lateral thrust to maintain a beam on position under severe conditions.

The use of thrusters provides a greater degree of lateral thrust and therefore an increased ability to keep station and manoeuvre.

There are two basic classes of thrusters; the transverse thruster which is fixed horizontally perpendicular to the vessel's center line and is integrated into the ship's hull and the compass or azimuth thruster which is onmi-directional and

which projects beyond the hull of the vessel. Other combinations integrate both systems and use a tunnel within the ship and a series of deflectors to give omni-directional capability.

The transverse thruster can be placed anywhere on the vessel, most commonly at the bow but with increasing frequency at the stern also. Although it may sometimes be desireable to have a stern thruster it is possible to achieve the same effects by using a bow thruster and contra-rotation of the twin main propellors to provide lateral thrust of the stern.

Transverse thrusters have the disadvantages of being only duo-directional and their effectiveness varies negatively with ahead and astern speed. However, they are used predominantly when the vessel is manoeuvring at low speeds.

Bow thrusters can often be lifted clear of the water during heavy pitching so that their overall effect is lessened by being in a light ship condition. However these disadvantages are insignificant compared to the overall increase in manoeuvring and station keeping capability that they provide.

There is an increasing use of compass or azimuth thrusters especially on rescue vessels in the North Sea. These are propellers, usually in nozzles, which project clear of the ship's hull and thus can rotate and give thrust in any direction through

360 degrees. They are about twenty percent more efficient than the tunnel thruster but prone, because of their design, to more mechanical faults.

They are used considerably on standby/rescue vessels in the North Sea because the majority of these vessels are conversions from vessels constructed with minimal positive manoeuvring characteristics. These generally are fishing vessels which, although they had good sea keeping qualities, did not need optimum manoeuvring capability. In many cases, the fishing vessel hull was not easily adaptable to the installation of tunnel thrusters and the azimuth thruster, which was installed externally, involved a minimum of hull adjustments. One azimuth thruster has the function of main forward and aft propulsion as well as omni-directional thrust and, to achieve this with bow and stern thrusters, main propulsion, and rudders is a more complex and expensive task.

The azimuth thruster does have distinct disadvantages. Primarily, it is an exposed unit and quite vulnerable to contact with the sea bottom in shallow waters, or susceptible to damage by ice.

For rescue purposes, two have been intalled in line a 'thwartships and situated midships (tractor propulsion) on the new purpose-built Kare Misje "Sentinel" class of rescue vessels.

The designer claims that their very depth in the water keeps them clear of potential survivors (and ice) and that the midships position of their installation keeps both ends of their vessel free of propellers, thus enabling the hull designers to be sure that their vessel proceeds with equal facility and sea keeping ability, ahead or astern.

None of the jurisdictions examined specify the propulsion systems required for standby vessels beyond specifying two sources of propulsion in the case of Norway.

The U.K. and Canadian regulations state that the standby vessel must be capable of performing its duties under all conditions. The U.K. regulations do require, however, that standby vessels presented for first certification after January 1, 1983 and which are certified for more than 250 survivors should have one or more thrusters.

The Norwegian regulations state that the maneurvering and positioning ability shall be sufficient to perform the work tasks envisaged but require that documentation be provided which shows that the vessel is capable of maintaining position and maneuvering in weather conditions corresponding to wind force 12 on the Beaufort Scale. This ability can be demonstrated through calculations, test task trials or by practical tests.

Hollobone Hibbert and Associates recommended that standby vessels should have as a minimum:

- twin screws and a bow thruster;
- or a single screw and a bow and a stern thruster, one of which should be an azimuthing thruster;
- or two azimuthing thrusters, one foreward and one aft.

This recommendation fulfills the requirement for two independent sources of propulsion and depending upon the horsepower available and the vessel configuration appears to be in keeping with the Norwegian requirements.

The study team is of the opinion that the recommendations made by Hollibone Hibbert and Associates should represent the minimum standard for standby vessels in Canadian waters. Vessels with propulsion systems which do not meet these standards should be required to present documentation or other proof of station keeping and manoeuvring ability.

The ease with which the various forms of propulsion can be controlled is recognized as being very important by the other jurisdictions. The Canadian regulations do not specify the control mechanisms required but the Norwegian regulations require that all vessel manoeuvring be easily performed from the commend center. Similarly, the U.K. regulations require that vessels which are presented for first certification after January 1, 1983 be fitted with full bridge control of propulsion machinery.

The study team feels that full bridge control of propulsion machinery is essential for standby vessels in Canadian waters and that a joystick control is a very desireable feature although not absolutely necessary.

Visibility

It is essential that the ship handler have sufficient visibility to carry out rescue operations which manoeuvring the vessel. The ship handler should be able to see the rescue zone, the waterline alongside the rescue zone, the helicopter winching area and the area for landing the personel basket.

Rescue Zone

All standby vessels should have a designated rescue zone for the recovery of survivors from the water.

The freeboard along this zone is critical for survivor recovery as it is an indication of the height that survivors must climb in order to board the vessel, or conversely, of the distance which rescuers must reach down to assist survivors. The presence of bulwarks or other obstructions in the rescue zone will effectively add on to the freeboard of the vessel.

Both the U.K. and Norwegian regulations provide for bulwarks

openings in the rescue zone with the Norwegians requiring an unobstructed opening of at least 15 meters in length and the U.K. requiring at least 3 meters in length on the smaller vessels (less than 150 survivors) and at least 6 meters in length on larger vessels (151 to 250 survivors).

The maximum allowable freeboard in the rescue zone also differs between the two jurisdictions. The Norwegian regulations previously specified a maximum freeboard of 2.5 meters but have now been revised to state that the freeboard will be evaluated separately for each vessel but that it should not be less than 1 meter.

The U.K. regulations specify a maximum freeboard of 1.75 meters in the rescue zone which probably corresponds to the arm span of a rescuer reaching down to a survivior who is reaching up.

The maximum allowable freeboard for vessels operating in Canada should be evaluated for each individual vessel but the study team is of the opinion that a freeboard in excess of 2.5 meters would not be acceptable. The 1.75 meter freeboard specified in the U.K. appears to be based upon some logic and would certainly be desireable for Canadian standby vessels.

The rescue zone should have sufficient space inboard to

facilitate the recovery of survivors. Norwegian regulations specify an area 3 meters inboard on each side of the ship which must be clear of equipment and other obstructions. This is regarded as a reasonable requirement for Canadian standby vessels.

Finally, the rescue zone should be located in an area which is clear of propellor wash and suction, where there are no overhangs fenders or other hull projections which could injure survivors and such that there is no run off of deck water or cooling water outlets to hamper access up the ships side.

Survivor Accomodations

Canadian regulations state that a standby vessel must have sufficient space to accomodate all persons from the drilling unit but it is not stated how much space is required per person or what can be regarded as survivor accomodations. Equipment is required for the treatment of 10 persons having burns, of 5 persons with fractures and of 5 persons suffering from hypothermia which implies that beds must be available for some of the survivors.

The Norwegian and U.K. regulations both state that the crew's accomodations can be used to calculate survivor space but that sanitary rooms, the master's cabin, the radio room and the wheelhouse must be excluded.

The U.K. regulations require that beds be available for 10% of the survivors and that not more than 10% of the survivors should be standing. An area of $.458m^2$ per seated person (80% of survivor capacity) and $.56m^2$ per standing person is required.

The Norwegian regulations state that berths must be available for not less than 20 survivors and that seats must be provided for the remainder with an area of $.5m^2$ per seated person being required.

The amount of survivor space required will depend largely upon the length of time that survivors will be required to remain on board the standby vessel and requirements for medical facilities, treatment rooms, and reception areas for the sorting of survivors also relates closely to survivor accomodation requirements. These medical requirements are beyond the scope of this study and are being addressed by other studies prepared for the Royal Commission.

In light of the other considerations which surround requirements for survivor accommodations, the study team does not consider it appropriate to suggest the amount of survivor space which is required. This issue should be examined in some detail by the appropriate regulatory authorities.

Towing Capability

The capability for towing should be considered in light of the need to tow other vessels or icebergs. This need may arise, as in the Euro Princess incident in the winter of 1982/83 off Sable Island, when this vessel, which had lost her manoeuvring capability, began drifting downwind to the jackup rig, Rowan Juneau.

Some dedicated standby/rescue vessels do have a rudementary means of towing. One purpose converted vessel in Canada is equipped with a towing hook and pennants and the new "Sentinel" class have a towing winch.

The argument that standby/rescue vessels are for personnel rescue and not property salvage or protection is valid but it is felt that the ability to tow a disabled vessel, thus preventing a possible collision with a MODU, is a more satisfactory solution than attempting to evacuate that MODU or having to rescue its crew from the water.

The ability to tow is also an advantage when dealing with icebergs. Ice management requires marine techniques of its own and dedicated craft equipped with a full scale towing winch, but it may be desireable to have some emergency iceberg towing capability in the standby vessel in the event that the rig

cannot be evacuated. There should, however, be a break contact point with the iceberg to attend the rig when the effort is not succeeding and the MODU is thus in immediate danger.

Helicopter Winching/Personnel Basket Area

Many of the rescue operations which may be carried out require an open deck area. An open area or areas is required for helicopter winching operations, landing a personnel basket from the MODU or landing the vessel's rescue basket. Although this could conceivably be one designated area for all three opertions, often the proximity of the vessel's rescue basket lifting device may preclude the use of the rescue basket area for helicopter winching or for landing the personnel basket.

The Norwegian regulations require that a standby vessel must have sufficient open deck space to handle a personnel basket and to perform helicopter hoist operations while the U.K. regulations specify that vessels with a capacity of 150 survivors or greater must have a helicopter winching area. A helicopter winching area and an area for landing a personnel basket is considered to be essential for Canadian standby vessels. This area should be free from aerials and other obstructions.

4.5.2 Rescue and Other Equipment Desireable for Canadian Waters

The Norwegian, United Kingdom and Canadian regulations all specify in some detail the rescue and other equipment which must be carried on standby vessels. Table 4.5 outlines the requirements for rescue equipment in each jurisdiction.

The Canadian requirements (COGLA and NLPD) compare favorably with the requirements in other jurisdictions and in some cases are in excess of their requirements. Some noteable exceptions to this are:

- Norway requires two rescue craft (one large rigid Man Overboard Boat and one Fast Rescue Craft).
- Norway and the United Kingdom require that it be possible to run the engine of the Fast Rescue Craft on board and, in the case of Norway, while the craft is being launched.
- Norway requires a rescue basket while COGLA does not. However, the NLPD does require this.
- Norway requires line throwing apparatus while COGLA does not. However, the NLPD does require this.
- Both Norway and the United Kingdom require diver's ladders while COGLA and NLPD do not.
- Norway requires surface swimming equipment.
- Norway requires four lines with safety hooks and helicopter harnesses.

TABLE 4.5

STANDBY VESSEL EQUIPMENT REQUIREMENTS

ITEM	NORWAY	UNITED KINGDOM	CANADA	
			COGLA	NLPD
1) Rescue Craft				
a) Number	2 min.	1 min.	1 min.	1 min.
b) Type	approved	acceptable	rigid or inflated (1)	rigid inflatable
c) Size	note specified	9 persons for vessels certified for up to 150 survivors. 15 persons for vessels certified for 151 to 250 survivors.	4.88m min.	not specified
d) Speed	one boat must be capable of 25kts with 3 persons on board	not specified	15kts with a full complement on board(1)	high speed
e) Deployment	suitable	system with a lowering speed of .3 to .6m/sec.	suitable(1)	suitable
f) Communications	VHF radio	VHF radio	two way radio	not specified
g) Lighting	2 searchlights	not specified	searchlight	sufficient searchlights
h) Other	must be possible to run engine on board the standby vessel and during launching.	must be possible to run the engine on board the standby vessel	not specified must have the capability to tow a survival craft	not specified

TABLE 4.5 (cont'd)

STANDBY VESSEL EQUIPMENT REQUIREMENTS

ITEM	NORWAY	UNITED KINGDOM	CANADA	
			COGLA	NLPD
2) Rescue Equip.				
a) Scramble Nets	1 on each side with fenders	1 on each side fitted on booms approximately .25m out from ship's side	1 on each side	2 min.
b) Rescue Basket	1 with an approved crane or other approved facility	not specified	not specified	1 with an over-side lifting device
c) Man Hooks	4 min.	not specified	4 min.	4 min.
d) Life Buoys	8 with buoy lanterns and lines	2 with lights & smoking signal 2 with lights 4 with 15 fathom lines Vessels for over 150 survivors require an additional 4 with 15 fathom lines	4 min. with heavy lines	4 with lines
e) Line Throwing Apparatus	required	not specified	not specified	required
f) Lifejackets	20 more than normally required	6 more than normally required	300% of normal crew complement	300% of normal crew complement
g) Survival Suits	for vessel crew	not specified	100% of certified crew complement	for vessel crew
h) Life Rafts	not specified	2 - each capable of accomodating the entire crew	300% of certified crew complement	300% of normal crew complement

TABLE 4.5 (cont'd)

STANDBY VESSEL EQUIPMENT REQUIREMENTS

ITEM	NORWAY	UNITED KINGDOM	CANADA	
			COGLA	NLPD
2) Rescue Equip. (continued)				
i) Ladders	one divers ladder	2 divers ladders 4 for vessels certified for more than 250 survivors	not specified	not specified
j) Surface Swimming Equipment	for 3 swimmers	not specified	not specified	not specified
k) Other	4 lines with safety hooks & helicopter harnesses running line on each side with 3 safety harnesses 2 attachment hooks for rescue lines on each side	loud hailer daylight signalling lamp		
3) Other Equip. a) Lighting	2 remote controlled searchlights	1 searchlight	2 searchlights	sufficient searchlights

- Norway requires a running line on each side of the vessel with three safety harnesses.
- Norway requires two attachment hooks for rescue lines on each side of the vessel.

It is felt that a combination of the requirement of the COGLA and NLPD regulations would represent an adequate standard of lifesaving equipment for standby vessels in Canada. Combining the requirements of these jurisdictions would result in the following equipment being required:

- 4 lifebuoys with lines
- 2 scramble nets, one on each side
- 1 rescue basket with a suitable lifting device
- 4 man hooks
- line throwing apparatus
- lifejackets for 300% of the normal crew complement
- survival suits for the entire vessel crew
- liferafts for 300% of the normal crew complement
- a minimum of two searchlights
- 1 rigid or rigid inflatable fast rescue craft with a suitable launching device.

In addition to these requirements, consideration should be given to providing safety harnesses and lines for the vessel crew who must work in the rescue zone as a precaution against being swept overboard under adverse conditions.

Surface swimmers can be useful to assist in rescuing persons from the water. However, this technique does involve an element of risk for the swimmers and would require a considerable amount of training. The study team feels that surface swimmers could be useful in some cases but does not feel that they should be a requirement on all standby vessels.

The rescue basket and the fast rescue craft are extremely important pieces of equipment. These are discussed in more detail below.

Rescue Basket

Rescue baskets such as the EMPRA or Bennex rescue baskets can serve to bridge the gap between the surface of the water and the standby vessel deck.

Rescue baskets are essentially a solid ring which floats at water level from which is suspended either a rigid frame or netting. The nets are suspended from the standby vessel's lifting equipment by a single point connection. They can be swung out over the standby vessel's side while the vessel is stationary and the survivors allowed to enter the basket or they can be swung out and trawled at low speeds to scoop up survivors.

Rescue baskets are usually deployed using a crane. A crane

provides the capability to deploy the basket at some distance from the vessel's side and can be used to accurately position the basket near survivors, thus reducing the precision with which the standby vessel must be manoeuvred.

If the basket is trawled the crane can be used to control the distance of the basket from the vessel's side (within the limits of the crane's reach) again reducing the need for precision manoeuvreing.

One of the problems with rescue baskets as with other rescue devices is the relative motion between the basket in the water and the vessel. The use of a high speed, heave compensated crane helps to alleviate this problem.

Fast Rescue Craft

The effectiveness of these craft depends largely upon the ability to launch and recover them under extreme conditions. Several launching systems are currently available.

The double purchase davit is the traditional way in which auxilliary craft have been launched and recovered from ships. It gives stability to the craft by its lifting and lowering control on both ends of the craft but has problems in the connection and disconnection stage. If there is not sycronization of the release

or connection of the forward and aft ends, then control is lost of one end. Some improvements have been made to double fall davits but the problems of sycronization of the release and connection appears to prohibit the use of double fall davits for Fast Rescue Craft off the East Coast of Canada.

The single purchase davit negates some of the release and reconnection problems inherent in the double purchase davit system but the heaving and lowering rates are relatively slow. The FRC is launched and recovered quite close to the side of the standby vessel which when combined with the slow heaving rates increases the possibility of impact. The design of these davits requires the FRC to navigate to a fixed point along the standby vessel in order to be recovered. This may not be possible in severe conditions.

The Miranda launching system is an upgraded version of the single fall system. The FRC is stowed in a cradle in the embarkation position. The cradle is lowered down the face of fixed ramp arms and the side of the vessel. Just prior to the craft's contact with the water the helmsman would apply power to the FRC engine, pull the lifting hook release and the craft steers out of the cradle and away from the standby vessel. The cradle is then lowered into the water until fully submerged ready for recovery of the FRC.

The Miranda system offers the advantages of being able to launch the FRC when the standby vessel is listing up to 30° or trimmed up to 15°. The cradle serves to hold the FRC stable and prevents it from impacting the side of the standby vessel while being launched.

One of the difficulties with the Miranda system is that the cradle is designed for narrower conventional small boats and as a result problems have occurred in securing the beamy FRC and in some cases the FRC may project outboard.

The design of the Miranda davit dictates that it must be stowed in a fairly substantial area near one side of the vessel thus exposing it to freezing spray and subsequent icing up. The davit can only launch and recover from one side of the vessel and the FRC must navigate to a single point over the cradle very close to the standby vessel in order to be recovered.

Despite these problems the Miranda davit can be an extremely effective launch and recovery system and is considered to be acceptable for standby vessels.

The Clara davit system is another version of the single fall system. A hydraulic winch allows the davit to swing outboard under its own weight where its outboard motion is arrested by two wires connected to the davit head. When the davit has reached its

outboard position, the hoist wire is stopped automatically preventing lowering of the boat until it is clear of the bulwarks. The boat is stabalized by a hooked arm which incorporates a boarding ladder. This arm moves outward with the boat allowing movement only in the required direction. The FRC is then lowered to the sea and launched.

During recovery the FRC's side is caught by the hooked arm when it reaches a height above the bulwark.

The Clara system occupies less deck space than other davit systems as the FRC is stowed overhead and offers a degree of control over the boat during launch and recovery. However, it suffers from problems in securing the beamy FRC and as with the Miranda system the boat can only be launched and recovered from one side. The raising and lowering speed of the system is quite low (15 m/min) and the FRC can only be recovered from one point along the standby vessel's side and the FRC is in danger of impacting the vessel side while it is being raised or lowered from the water to the top of the bulwarks.

The Yo Yo system is used with either single or double falls and incorporates a tensioning system for wave compensation. It thus can be used in moderately heavy areas but again only from one side of the vessel. The design of the system necessitates relatively low raising and lowering speeds which increase the

time that the FRC is exposed to impact with the standby vessel and again the FRC must navigate to a fixed point along the vessel side in order to be recovered.

Cranes are commonly used to launch FRC. To be effective in launching and recovering the FRC the crane must be fully slewing and luffing with a single heave compensated high speed whip. Ideally, the crane should be capable of launching FRC from either side of the standby vessel.

The crane offers the advantages of being capable of quickly lowering the FRC at a distance from the vessel which will avoid impact with the vessel sides. The direction of the FRC prior to launch can be controlled using lines from the standby vessel deck. In the recovery of an FRC the crane offers the advantage of being able to recover the FRC anywhere within its radius of action and therefore the FRC does not have to navigate to a relatively fixed point alongside the standby vessel. A high speed heave compensated crane should be able to launch and recover an FRC in heavy seas and in the opinion of the study team represents the best method currently available of launching and recovering the FRC.

There are two types of fast rescue craft in use: the rigid bottom inflatable and the rigid vessel commonly referred to as a pick-up boat (PUB) or man overboard boat (MOB).

The rigid inflatable craft consists of a rigid hull generally constructed from aluminum or glass reinforced plastic (GRP) which is surrounded by a floatation collar of laminated fabric. These craft are constructed in such a way that either the rigid hull or the floatation collar will provide sufficient buoyancy to keep the craft afloat without the buoyancy of the other. These craft are extremely stable and can operate under extremely severe conditions. Hollibone Hibbert and Associates state that these craft will probably remain safe in all sea conditions under which they could be launched or recovered.

These craft are powered by either inboard diesel jet drives or gasoline outboard propeller drives and have a speed of 20 to 30 kts. Each type of engine and drive offers several advantages and disadvantages.

Outboard motors offer the advantages of: having power provided by two motors which represents a degree of redundancy, being easily replaced, and having high power to weight ratios.

Some disadvantages of outboard motors include: a watertight integrity which is inferior to that of the diesel, only being able to use a propellor which could injure survivors, and an inability to be warmed up without cooling water prior to use.

The diesel inboard engine on the other hand offers an ability to be warmed up while out of the water, water tight integrity and a lower center of gravity. The diesel engine however is heavier than the outboard for an equivalent amount of power and a single diesel engine does not offer the redundancy of two outboards nor the ease of replacement.

The propellor drive offers high efficiency at all revolutions but with a heavy load there is a considerable decrease in efficiency and the propellor is vulnerable to obstructions and potentially dangerous to persons in the water.

The water jet has a lower efficiency at low rpm but can be more efficient than a propellor under load. Sharper turns are possible with the jet drive and an instantaneous reversal of propulsion force without strain on the engine is possible. The jet drive also does not present a hazard to persons in the water.

There is however, some loss of performance in broken seas and the jet has a poor efficiency in aerated water.

There exists a difference of opinion on the merits of the outboard propellor and inboard diesel jet drives. The U.K. allows either type of drive while Norway requires a jet drive.

The capability to run and warm up the engine while out of the water is a desireable characteristic in light of the low ambient temperatures off the East Coast of Canada and would favor the use of the inboard diesel jet drive.

Rigid inflatable craft range from 15 feet to over 35 feet in length with the smaller craft capable of accomodating from 10 to 15 persons including a crew of 2 or 3.

The rigid displacement craft or MOB are of similar size and capacity as the rigid inflatables although they have less power and therefore are not capable of as high a speed (approximately 15 kts). They are generally of fibreglass construction, are self righting, have a half canopy and is a low freeboard aft.

They can be adapted for self spray and enclosed controls and therefore could be more effective in a fire on water situation than a rigid inflatable. These craft are generally regarded as a secondary rescue craft as they are not as fast as the rigid inflatable and do not have as good sea keeping characteristics.

The COGLA requirements for rescue boats are outlined in some detail in the "Requirements for issue of Letter of Compliance for Standby Vessels", a copy of which is attached in Annex G.

These requirements specify that the rescue boat must be an approved rigid or inflated boat which is assumed to mean that it must comply with the standards for rescue boats outlined under the "Proposed Standards for the Construction, Inspection and Testing of Rescue Boats" which is also attached in Annex G. The term inflated encompasses both inflatable boats and rigid inflatables.

The requirements for the issue of a Letter of Compliance also specify that the rescue boat must be at least 4.88m in length, be capable of maintaining 15kts fully loaded for one hour, be equipped with a searchlight, be equipped with a two way radio and must have the capability to tow a survival craft. The requirement for towing capability would preclude the use of an inflatable boat without a rigid hull as a rescue boat on a standby vessel.

The study team agrees with the requirements outlined for rescue boats in the Letter of Compliance and feels that they represent an adequate standard. However, the rigid inflatable craft should be the preferred rescue craft for standby vessels although rigid rescue craft are acceptable.

4.5.3 The Suitability of Standby Vessels in Canada

The particulars of the vessels in use by the oil industry in Eastern Canada are outlined in Table 3.1. This section will

discuss only the particulars of the vessels themselves without reference to the rescue equipment which is carried.

Since most of the standby vessels in use in Eastern Canada are supply vessels, the discussion will be focussed upon these vessels. However, reference will be made, when appropriate, to purpose built rescue vessels such as the "Sentinel" class of vessels and to purpose converted standby/rescue vessels.

One such vessel (Vessel S, Table 3.1) has gone through an extensive conversion from a fishing vessel to a standby vessel and its sister ship is currently performing standby duties in the North Sea. This vessel therefore can be used as a basis of comparison to the North Sea. It should be noted that not all fishing vessels in use as standby vessels in the North Sea, particularly in the U.K. sector, have been as extensively converted. The difference lies in the propulsion and manoeuvring machinery which has been added to this vessel for rescue work. Many converted fishing vessels in use in the North Sea do not have two independent sources of propulsion and many have only limited thruster power.

Dimensions

The standby/rescue vessels in Canada which also function as supply or anchor handling vessels are of such dimensions as will make them compatable with the carriage of cargo, towing and

anchor handling. These dimensions give the vessels more length, beam and depth than most purpose built rescue ships and thus a potential to accomodate more rescue equipment such as cranes, fast rescue craft, etc.

The "Sentinal" class rescue vessels for example, have a length overall of 48.8 meters and a breadth of 11 meters and most fishing vessels which have been converted for rescue work are smaller than the "Sentinal" vessels.

All of the supply vessels off Eastern Canada are in excess of 55 meters in length and 14 meters breadth with only one vessel being less than 60 meters long. However, the purpose converted fishing vessels examined are generally somewhat smaller.

All of the Canadian vessels exceed the 40 meter length suggested as a minimum.

Stability and Construction

Stability and construction criteria for standby vessels must be based upon the regulations of the flag state and the rules of classification societies. All of the vessels examined, with the exception of five, are Canadian registered and therefore must comply with Canadian regulations. The remaining five consists of four which are British registered, and one which is registered in

West Germany. These vessels would therefore be required to comply with the requirements of their respective flag states.

A large percentage of the vessels are also classed to varying degrees for operations in ice or in the presence of ice. Depending upon the area of operations of each individual vessel classing for ice may or may not be necessary and therefore comment cannot be made on the adequacy of the ice classes for these vessels.

Seakeeping

Supply vessels have good seakeeping ability by virtue of their size and manoeuvring ability.

There is some compromise in areas such as the open square counter stern configuration and the forward superstructure position which is required by the supply role. Because of the sail effect of the forward superstructure, the vessel will tend to point the stern into the wind leaving it open to the seas and the counter slamming into these seas when at rest.

To alleviate this problem most supply vessels lie so that the wind is on one quarter or the other or in extreme seas a head on altitude can eliminate these problems.

A purpose built rescue vessel on the other hand can have a canoe stern enabling it to proceed with equal facility stern first.

Station Keeping and Manoeuverability

The configuration of the propulsion machinery, the horsepower which is available to this machinery, and the design and dimensions of the vessel are the major factors which govern the ability of a vessel to manoeuvre and keep station. The supply vessels in use off Eastern Canada tend to be larger than the purpose built rescue vessels or the converted fishing vessels but they also have much more horsepower available. One of the prime functions of supply vessels is the carriage of heavy cargo. The carriage of heavy cargo and its loading and unloading at a MODU dictates that these vessels must be capable of manoeuvring and keeping station with a dead weight in excess of the light ship weight and this is allowed for in the power supplied. It follows then, that if the vessel is capable of manoeuvring and keeping station in a loaded condition, its ability to perform these functions will be enhanced when the vessel is not loaded as is the case when it is performing standby duties.

All of the supply vessels and two of the three converted vessels examined meet the criteria developed for propulsion machinery.

The supply vessels all have two independent forms of propulsion by virtue of having twin screws while two of the converted fishing vessels have an independently powered azimuthing bow thruster. Only one of the forty vessels in use off Eastern Canada does not meet this requirement. This vessel is a converted sealing vessel which has a single screw and transverse thrusters.

Ten of the anchor handling/platform supply vessels and four of the platform supply vessels have twin propulsion, two bow thrusters, and one stern thruster. The twenty remaining anchor handling/platform supply vessels have twin screws and a bow thruster and the three remaining platform supply vessels have twin screws, two bow thrusters, and two stern thrusters.

Two of the three converted vessels have only one screw but one has an azimuthing bow thruster, and a stern thruster while the other has a bow, and a stern thruster. The other converted vessel has twin screws, a stern thruster, and an azimuthing bow thruster.

An analysis of the ability of these vessels to manoeuvre and keep station is not possible within the context of this study but it appears that all of the vessels have sufficient main engine and thruster power to carry out these functions under extreme conditions.

All of the vessels in use off Eastern Canada are equipped with full bridge control of propulsion machinery. Joystick control is installed on sixteen of the thirty anchor handling/supply vessels, on one of the seven platform supply vessels, and on one of the converted vessels. The six remaining platform supply vessels are dynamically positioned.

In conclusion, 39 of the 40 vessels in use off the East Coast of Canada meet all of the outlined criteria for station keeping and manoeuvring. The one vessel which does not, a converted vessel, may well have sufficient power and thrusters to manoeuvre and keep station under extreme conditions but it does not have two independent sources of propulsion.

Rescue Zone

The rescue zone on all of the supply vessels, by virtue of their configuration, is slightly aft of the waist of the vessel. The zone is within the visibility of the ship handler in all cases but three of the platform supply vessels have bulwarks of such height that visibility of activity in the water alongside the zone would be minimal from the ship handler's position. However, these three vessels all have conventional bridge wings with a good line of sight on the water side of the rescue zone and the vessels are either dynamically positioned or have joystick control. These vessels would therefore require an extra man on the bridge wing to liase with the ship handler.

The rescue zone on the supply vessels and on the converted vessels is located away from propellor and thruster wash or suction.

The freeboard of all of the vessels in use is less than 2.5 meters. However, four platform supply vessels and seven anchor handling/supply vessels have freeboards in excess of 1.75 meters. These freeboards are 1.8 meters for the four platform supply vessels and 2.21 meters for the seven anchor handling/supply vessels.

Most of the vessels have bulwarks in the rescue zone, the height of which is not known. Some of the vessels have a swing open section in the bulwark but the length of that section is dictated by the amount of space between the bulwark and the inboard cargo rail when the section opens inwards. Three of the platform supply vessels have very high sides even though their freeboard is less than 1.75m. These high sides would preclude the use of these vessels unless openings could be made in the rescue zone in which case the visibility problem noted earlier may also be alleviated.

All supply vessels have cargo rails located inboard of the ships side which can obstruct clear passage to and from the rescue zone and which affects the ability to install a swing open section in the bulwark. If the cargo rails present these

problems, consideration might be given to specially strengthened removeable sections in these cargo rails.

One of the advantages of purpose built rescue vessels such as the Sentinal Class and of purpose converted fishing vessels is that these vessels can have a special zone which is free of obstructions. The cargo carriage function of supply vessels dictates that the vessels have inboard cargo rails which in turn may restrict access to the rescue zone or the ability to install bulwarks openings. This problem must be remedied on supply vessels which are to be used for standby duties.

All of the vessels in use off the East Coast of Canada meet the requirements developed for a rescue zone in terms of freeboard, location and visibility. However, bulwarks height and restrictions due to cargo rails may make some of these vessels unsuitable. The three platform supply vessels with high sides are unsuitable due to the excessive height that a survivor would have to climb and the restricted visibility of the ship handler but if suitable openings could be made in the sides these vessels may be acceptable.

Survivor Accomodation

Canada has no regulations for standby/rescue vessel accomodation but if .5m^2 per person is used as a standard, all of

the supply vessels could accomodate at least 80 persons although not all could be seated.

Towing Capability

All of the anchor handling/supply vessels have towing capability by virtue of their primary roles. Two of the platform supply vessels and one of the converted fishing vessels also have some towing capability but this is considerably less than that of the anchor handling/supply vessels.

Helicopter Winching/Personnel Basket Area

All of the vessels in use in Eastern Canada have an area which could be used for helicopter winching or landing a personnel basket.

The anchor handling/supply vessels have a large open deck aft which provides a large area for this purpose. This open deck may be more restricted on the platform supply vessels especially on the three vessels which have the high sides.

General Considerations

One of the main advantages of purpose built standby vessels or of vessels which are purposely converted for standby work is that the rescue role is not compromised by other duties.

The carriage of cargo on supply vessels will affect the freeboard of the vessel and to some extent its ability to manoeuvre. A loaded supply vessel does not have an open area for helicopter winching or for landing a personnel basket and while the carriage of cargo does not affect the immediate water/deck interface in the rescue zone, due to the restriction of the cargo between the cargo rails, it can affect access to and from the rescue zone.

For these reasons no supply vessel should take up standby duties while loaded or while performing other duties such as diving support or iceberg towing. The routine for supply vessels on standby duty should consist of:

a) the loaded vessel arrives at the MODU and discharges its cargo,

b) the vessel takes over from the previous standby vessel which then backloads and departs,

c) the vessel performs standby duties until the next vessel arrives, offloads its cargo and takes up standby duties, and

d) the vessel which has been relieved of standby duties then backloads and departs the MODU.

The use of supply vessels as standby vessels in Eastern Canada is therefore subject to some constraints. The vessels must meet the criteria outlined and there must be no compromizing of the vessel's role when it is performing standby duties.

Of the forty vessels examined, thirty-six appear to meet the criteria outlined for standby vessels. Three of the platform supply vessels do not by virtue of their having extremely high sides in the rescue zone and one converted fishing vessel does not as it does not have two independent sources of propulsion.

Although only four vessels appear not to meet the criteria other vessels may also not be suitable by virtue of having cargo rails which restrict access to the rescue zone or by having bulwarks in the rescue zone which result in an excessive height which a survivor would have to climb. In addition, some of these vessels may not be outfitted with the proper rescue equipment to qualify as suitable standby vessels.

4.5.4 Suitability of Rescue Equipment on Standby Vessels in Canada

General Equipment

COGLA and the Canadian Coast Guard are now issuing a Letter of Compliance to vessels which will be used for standby duties. The vessels are inspected by the Coast Guard to ensure that the required rescue equipment is in fact on board. The equipment required is similar to that outlined in Section 4.5.2 and includes:

- 4 lifebuoys with lines
- 2 scramble nets
- 4 man hooks
- 2 searchlights
- lifejackets for 300% of the normal crew compliment
- survival suits for the entire vessel crew
- liferafts for 300% of the normal crew compliment

Information was not available on whether the vessels in Eastern Canada carry all of the equipment listed above. This equipment, along with the line throwing apparatus and safety harnesses and lines for the vessel crew, which the study team identified as being necessary, could easily be added to any vessel.

The major pieces of equipment which are currently required for standby duties are a fast rescue craft and its launching device. Since the FRC has been required for some time, its presence is perhaps the best indication of whether a vessel is equipped for standby duties.

Thirty-six of the forty vessels operating off the East Coast carry either a fast rescue craft or a man overboard boat and all of the vessels carry the required number of scramble nets and man hooks. This implies that all of these vessels can be used for standby duties.

MOB FRC and Launching System

The study team concluded in Section 4.5.2 that both the rigid man overboard boat and the rigid inflatable fast rescue craft are acceptable rescue boats but that the rigid inflatable craft should be the preferred rescue boat for standby vessels. A crane was felt to be the most suitable launching device but some davits such as the Miranda system were felt to be adequate.

As was noted, thirty-six of the forty vessels carry either a rigid man overboard boat or a rigid inflatable fast rescue craft. Twenty-eight vessels carry only a fast rescue craft, four carry only rigid man overboard boats (3 have 2 MOB) and four vessels carry a rigid man overboard boat and a fast rescue craft.

Thirty vessels launch either the rigid man overboard boat or the fast rescue craft using a crane, two vessels launch using Miranda davits and only four use conventional davits.

The vessels can be categorized by the type of rescue boat and launching system according to the criteria developed.

1) Preferred System
   Rigid Inflatable Fast rescue craft; crane launched - 29 vessels

2) Adequate System

   Rigid Inflatable Fast rescue craft; Miranda Davit - 2 vessels

3) Adequate System

   Rigid Man Overboard boat; crane launched - 1 vessel

4) Unacceptable

   Rigid Man Overboard boat or Rigid Inflatable Fast rescue craft; conventional davits - 4 vessels.

The placement of most of the cranes installed on supply vessels in Canada restricts their use to one side of the vessel. This placement is dictated by constructional convenience.

Rescue Basket

Thirty-three of the forty vessels in Eastern Canada carry a rescue basket. However, only twenty-seven of these thirty-three have a crane. It is not known if the rescue basket can be deployed over the vessel's side on the remaining six vessels or if it is simply stored on board for use by helicopters. There are four vessels in the fleet which have a crane but do not have a rescue basket.

4.5.5 Status of Standby Vessels and Equipment in Canada

There are currently 26 vessels operating on the East Coast which are equipped with a MOB or a FRC, use either a crane or Miranda davits to launch these craft, and which have a rescue basket with a crane. However, three of these vessels are the platform supply vessels with high sides and one of them is the converted vessel which does not have two independent sources of propulsion. Assuming that all of the other required equipment is in place, there are therefore twenty-two vessels which are considered to be adequate standby vessels.

There are four vessels which meet all of the criteria outlined above but which do not have a rescue basket on board.

Six vessels are not deemed to be adequate because they use conventional davits to launch the MOB or FRC or because they do not have a crane for deploying a rescue basket.

Only four vessels are not equipped to some extent (i.e. no basket and no FRC or MOB) for rescue duties. None of these vessels have a crane.

There appears to be a sufficient number of vessels which meet all of the criteria for standby vessels to service the MODU's currently operating off Eastern Canada.

The system of using supply vessels as standby vessels has resulted in a large percentage of the total fleet having had rescue equipment installed. Although all of the vessels cannot be considered suitable standby vessels the addition of this rescue equipment on all of the vessels represents an enhancement of the overall rescue capability. Almost the entire supply vessel fleet in Canada has some rescue capability in excess of that which would be found on a merchant ship, for example.

If the use of supply vessels as standby vessels was discontinued and purpose built rescue vessels or purpose converted vessels whose only duties were standby were to be used there would probably be a deterioration of the levels of rescue equipment which is place on the supply vessels and a resulting deterioration of the overall rescue capability. The use of purpose built rescue vessels or purpose converted vessels might result in a marginal increase in the standby vessel rescue capability as there would be no compromising of the vessel's design or equipment, but this should not be done at the expense of not upgrading the supply vessels.

4.5.6 Suitability of SAR Vessels

Section 2.4.2 outlined the particulars of the four Canadian Coast Guard Primary SAR vessels. Although these vessels are not used as standby vessels their prime function is Search and Rescue. The equiment carried on the vessels and the design of these vessels should therefore be similar to that which is required for industry standby vessels.

Dimensions

All of the vessels are over 55 meters in length and as such are well in excess of the 40 meter minimum suggested.

Stability and Construction

All of the vessels meet the Canadian requirements for stability and construction. Three of these vessels are supply vessel design while one, the Alert, was designed and built for rescue work. Three of the vessels are classed for operations in ice while the Alert is not.

Station Keeping and Manouvereability

All of the vessels meet the criteria outlined for propulsion equipment. All have two screws and a bow thruster. The vessels

all have main engine power which is comparable to that on the anchor handling/platform supply and the platform supply vessels but the thruster horesepower available is less than on these vessels. Only one anchor handling/platform supply vessel has less than a 500 hp bow thruster while the platform supply vessels have at least 1200 hp bow thrusters. By comparison, the Grenfell and Jackman have 360 hp bow thrusters, the Alert has a 200 hp bow thruster and the new vessel which will replace the Daring has a 275 hp bow thruster.

The new vessel which will replace the Daring will have joystick control while the other three have bridge control of propulsion machinery.

Rescue Zone

The rescue zone on all of the primary SAR vessels is located near midships which places it away from propellor and thruster wash and suction.

The freeboard on all the vessels is less than 1.3 meters but the Alert Grenfell and Jackman all have bulwarks in this area which add considerably to the height which a survivor must climb.

Towing Capability

All of the vessels have towing capability.

Helicopter Winching/Personnel Basket Area

All of the vessels have an area for helicopter winching and the Alert has a helideck.

Scramble Nets

All of the vessels are equipped with scramble nets.

Rescue Basket

None of the primary SAR vessels are equipped with a rescue basket.

MOB, FRC and Launching Systems

The Grenfell and the Jackman carry a rigid man overboard boat and a rigid inflatable fast rescue boat. Both boats are launched and recovered using a three tonne crane.

The Alert carries two inflatable Zodiac rescue boats which are 4 meters in length. Because of their length and due to their construction these rescue boats would not meet the criteria outlined in the Letter of Compliance for Standby Vessels.

The new vessel which will replace the Daring will be equipped with a rigid man-overboard boat and a rigid inflatable fast rescue craft, either of which would meet the criteria suggested. However, a conventional davit launching system will be used for these craft which would not meet the criteria outlined in Section 4.5.2.

Other Equipment

All of the vessels carry searchlights, line throwing apparatus and survival suits for the entire crew. Grenfell and Jackman carry liferafts with a capacity in excess of 300% of the normal crew compliment.

Summary

None of the primary SAR vessels, as they are presently equipped, meet all of the criteria outlined for standby vessels. The vessels have the same problems with bulwarks in the rescue zone as do the industry vessels but these could possibly be alleviated.

None of the vessels carry a rescue basket. The Grenfell and Jackman have a crane which could possibly be used to deploy a rescue basket if one were installed, but the cranes on the Alert may not have sufficient capacity.

The Alert does not have a suitable fast rescue craft but the installation of such a craft is planned.

4.5.7 Conclusions

Standby Vessel Characteristics

1) The desireable characteristics of standby vessels for Canadian waters are as follows:

- Dimensions – minimum length of approximately 40 meters
- Stability – based upon regulations and classification society rules
- Construction – based upon regulations and classification society rules
  – Canadian ice class for areas where ice is a possibility
- Seakeeping – should be evaluated on an individual vessel basis
- Station Keeping and Manoeuvrability
  – twin screws and a bow thruster
  – or a single screw and a bow and stern thruster one of which is an azimuthing thruster

	- or two azimuthing thrusters, one fore and one aft
	- vessels which do not comply with the above should be required to demonstrate station keeping and manoeuvring ability
	- full bridge control of all propulsion machinery
. Visibility	- rescue zone, waterline alongside the rescue zone, helicopter winching and personnel basket area from the bridge
. Rescue Zone	- unobstructed freeboard (i.e. the height which survivors must climb) of not more than 2.5 meters and preferably not more than 1.75 meters
	- may have bulwarks openings
	- minimum unobstructed area of at least 3 meters inboard of each side of the vessel in the rescue zone
	- should be clear of propellors and thrusters
	- should be clear of overhangs, fenders or other hull projections
	- should be in an area free of deck water runoff or cooling water outlets

- Survivor Accomodations
  - requirements need to be evaluated in light of medical requirements and the amount of time that survivors will remain on board
- Towing Capability
  - desireable but not absolutely necessary
- Helicopter Winching/Personnel Basket Area
  - required.

2) The Canadian regulations do not specify the characteristics such as minimum length, propulsion equipment, propulsion control and freeboard which a standby vessel must have.

3) The subject of survivor accomodation criteria is not addressed by the Canadian regulations.

Rescue Equipment

4) Rescue equipment which should be carried on standby vessels includes:
   - 4 lifebuoys with lines
   - 2 scramble nets
   - 4 man hooks
   - lifejackets for 300% of the normal crew compliment
   - survival suits for the entire vessel crew
   - liferafts for 300% of the normal crew compliment

- a minimum of two searchlights
- a rescue basket with a suitable lifting device
- a rigid man overboard boat or rigid inflatable fast rescue craft with a suitable launching device. This craft should be:
    a) capable of maintaining 15 kts for 1 hour when carryng a full compliment and equipment
    b) capable of towing a survival craft
    c) equipped with an efficient searchlight
    d) equipped with a two way radio
    e) equipped with an engine which can be warmed up and run while out of the water
- safety harness and lines for the vessel crew.

5) Canadian regulations do not require that standby vessels carry line throwing apparatus, safety harnesses and lines for the vessel crew or a rescue basket with a lifting device.

6) Canadian regulations do not require that the fast rescue craft be equipped with an engine which can be warmed up and run while out of the water.

7) Canadian regulations do not specify the type of launching system required for the fast rescue craft.

<u>Canadian Standby/Rescue Vessels</u>

8) Thirty-six of the forty vessels operating on the East Coast of Canada <u>appear</u> to meet all of the vessel criteria outlined in conclusion #1.

9) The presence of cargo rails which restrict access to the rescue zone and of bulwarks which result in an excessive height that survivors would have to climb in the rescue zone may disqualify some of the vessels which appear to meet the criteria for standby vessels.

<u>Canadian Standby/Rescue Vessel Equipment</u>

10) Twenty-two vessels currently operating on the East Coast of Canada appear to meet the equipment criteria for fast rescue boats, launching systems, and rescue baskets as well as the criteria outlined in conclusion #1.

11) Four other vessels currently operating on the East Coast of Canada appear to need only to add a rescue basket to meet all of the criteria.

12) The majority of the oil industry fleet has a rescue capability in excess of that carried by other ships.

13) If properly equipped, supply vessels represent an adequate standby vessel, however purpose built rescue vessels may have a slightly better rescue capability.

14) The use of vessels for other duties while they are functioning as standby vessels can seriously compromise their rescue capability.

Canadian Coast Guard Primary SAR Vessels

15) The Canadian Coast Guard SAR vessels appear to meet all of the vessel criteria outlined in conclusion #1.

16) The presence of bulwarks in the rescue zone on Canadian Coast Guard ships may result in an excessive height which survivors would have to climb.

17) Canadian Coast Guard Alert does not carry a fast rescue craft which meets the requirements outlined for standby vessels.

18) None of the primary SAR vessels carry a rescue basket.

4.5.8 Recommendations

1) Regulations or guidelines should be developed which outline the characteristics necessary for standby vessels.

2) Until more detailed specifications for standby vessels can be developed, those outlined in conclusion #1 should be used in assessing the suitability of vessels.

3) The question of survivor accomodations, medical facilities and survivor reception areas on standby vessels should be examined and standards developed.

4) A rescue basket which can be deployed and retrieved over the ships side, line throwing apparatus, and safety harnesses and lines for the vessel's crew should be required on standby vessels in addition to the equipment already required by regulation.

5) In addition to the present requirements for fast rescue craft on standby vessels, these craft should be equipped with an engine which can be run and warmed up while out of the water.

6) Regulations should be developed which outline the capabilities that the FRC or MOB launching system must have.

7) Supply vessels currently in use as standby vessels should be inspected to ensure that cargo rails do not restrict access to the rescue zone and that bulwarks in the rescue zone do not result in an excessive height which survivors must climb. This height should not exceed 2.5 meters.

8) Standby vessels with excessive bulwark height in the rescue zone or with cargo rails which restrict access to the rescue zone should be equipped with bulwarks openings or with removeable sections in the cargo rails if this is possible.

9) Supply vessels should be allowed to continue to function as standby vessels provided that they meet the vessel characteristics outlined in conclusion #1 and are equipped as outlined in conclusion #4.

10) The enhanced rescue capability present on the majority of the supply vessel fleet should be maintained even if purpose built or purpose converted dedicated rescue vessels become the norm in Eastern Canada.

11) Vessels functioning as standby vessels should not be allowed to carry out other functions such as diving support, cargo loading or unloading or carrying cargo on deck while in the standby role.

Canadian Coast Guard Primary SAR Vessels

12) Canadian Coast Guard primary SAR vessels should meet, as a minimum, the same criteria for vessel characteristics and rescue equipment as is required for oil industry standby vessels.

13) An approved rigid inflatable fast rescue craft should be placed on the Alert.

4.6 TRAINING OF RCC AND MARINE PERSONNEL

The training of industry and SAR aircrews was discussed in Section 4.4 as it relates closely to the rescue techniques which are used. This section will therefore discuss only the training of personnel who man the Rescue Coordination Centers and of marine personnel on industry standby vessels and on primary SAR vessels.

4.6.1 Training of RCC Personnel

Marine Controller

The requirement for a marine controller is a CCG Watchkeeping Mate Certificate of Competency. Although the statement of qualifications for this position states that the individual should have practical shipboard experience in assisting in the conduct and coordination of Search and Rescue Operations, the CCG Watchkeeping Mate Certificate of Competency does not ensure that this in fact, will be the case. The usefullness of this watchkeeping certificate as a minimum standard is therefore suspect as the sea experience required is minimal and the person need not have any experience in Search and Rescue.

Marine Controller's were previously required to hold a master mariner's ticket, a prerequisite which is felt to represent a more adequate standard.

Air Controllers

The present practice of recruiting air controllers from SAR aircraft crews is judged to be adequate as this practice ensures that the individuals will have "hands-on" experience in air search and rescue.

4.6.2 Training of Marine Personnel

The training for the crews of Primary SAR vessels and for industry standby vessels is similar. All of the certified officers on these vessels have taken the MED II course as a prerequisite to receiving certification. Some of the non-certified crew on the SAR and industry vessels have also received the MED II training.

The Masters of both the SAR and industry vessels may have taken MED III and as a result will have a slightly increased training in search and rescue and will have training in CPR but this will depend upon when the individual received his master's ticket.

Members of the crew on SAR and industry vessels who have not received the MED II course will probably have had no formal training in search and rescue.

Both Norway and the United Kingdom require that standby vessel crews receive a course in basic sea survival and in rescue procedures. While the MED II course does teach basic sea survival it does not adequately address rescue procedures. It is felt that the MED II or a similar basic sea survival course should be mandatory for the entire crew of primary SAR vessels and of industry standby vessels. In addition, formal training in rescue procedures should also be mandatory for the entire crew of these vessels. Since the MED II course is not considered to provide adequate formal training in rescue procedures a course would have to be developed to provide this training.

Industry standby vessels are all equipped with rescue boats. The current practice is to have three men from each crew attend a fast rescue boat course. These courses given in Canada are similar to those in Norway and the United Kingdom and, in the opinion of the study team, represent an adequate level of training for the rescue boat crews.

Personnel on primary SAR vessels do not receive formal fast rescue craft training. The Coast Guard relies upon drills and exercises on board each vessel to develop proficiency in the use of rescue boats. The frequency and types of drills are largely at the commanding officer's discretion.

Some of the senior officers of primary SAR vessels attend the National Marine Search and Rescue course while some senior officers of industry vessels attend the PITS Senior Officer Emergency Management Forum. No assessment of the suitability of these courses can be made.

4.6.3 Conclusions

RCC Personnel

1) The Watchkeeping Mate Certificate of Competency for RCC Marine Controllers does not ensure an adequate knowledge of SAR operations.
2) Recruitment of SAR aircrew for RCC Air Controllers ensures that the individuals have sufficient experience in SAR operations.

Marine Personnel

3) The levels of training received by the crews of primary SAR vessels and of industry standby vessels in basic sea survival and in general rescue procedures are similar. The entire crew of these vessels presently do not receive training on these subjects.
4) Fast rescue craft crews on industry standby vessels receive formal training on the use of these craft. This training is judged to be adequate.
5) Fast rescue craft crews on primary SAR vessels do not receive formal training in the use of these craft.

4.6.4 Recommendations

1) RCC marine controllers should be required to have a Master Mariner's Certificate.
2) The practice of recruiting RCC Air Controllers from SAR air crews should be continued.
3) All crew members of primary SAR vessels and of industry standby vessels should have formal training in basic sea survival such as that given by the MED II course. This should include training in basic first aid.
4) All crew members of primary SAR vessels and of industry standby vessels should receive formal training in rescue techniques similar to that received in the UK and Norway.
5) CCG and the industry should initiate the development of an appropriate course in rescue techniques.
6) CCG should provide formal fast rescue craft training for the appropriate number of crew members on each primary SAR vessel.

4.7 GENERAL CONSIDERATIONS IN SEARCH AND RESCUE

The preceding sections have discussed the specifics of the management of search and rescue, the equipment used and the training required for search and rescue. There are, however, some general comments which should be considered for SAR. These comments apply equally to the use of air or marine resources in SAR.

4.7.1 Survivor Localization

In the case of a disaster to a MODU, a supply vessel or helicopter the location of the incident can often be located by homing in on the Emergency Position Indicating Radio Beacon (EPIRB) in the case of a MODU or supply vessel or on the Emergency Locator Transmitter (ELT) in the case of a helicopter.

SAR helicopters and ships are equipped with direction finding homers which can be used to guide them to the site of the incident provided that the MODU, supply vessel or helicopter is still afloat.

Similarly lifeboats and liferafts can be located by homing in on the EPIRB. The use of these devices on lifeboats and liferafts is extremely important as these craft may be scattered at some distance from the scene of the incident and visual location may be extremely difficult under conditions of low visibility.

Persons in the water present an even greater problem. The survival time of a person in the water, even if he is wearing a survival suit, is limited and thus must be localized in a very short timeframe.

Lifejackets and survival suits currently in use have the following features to assist in localization:

- bright colors or flourescent material
- retro-reflective tape
- sea activated marker lights
- dye marker
- whistle

These aids are not considered to be adequate. At night, during conditions of poor visibility, even though the rescue craft may have a good position fix on the scene of an incident survivors may have drifted out of the area which may preclude quick visual location, particularly for rescue vessels. During the day retro-reflective tape and sea activated lights become invisible.

The experience of SAR personnel is that a strobe light, such as is used by the Canadian Armed Forces can provide a good visual contact by day or night. In addition to the strobe light consideration should be given to incorporating a Personal Locator Beacon into survival suits and lifejackets. Equipment of this type is under development in Norway.

Another method of survivor location is the use of passive infra-red detection. A Forward-Looking Infra-Red (ELIR) is currently in use on some SAR helicopters in the North Sea and has been found to be very effective.

4.7.2 Survivor Recovery

On many occasions, whether the rescue vehicle is a vessel or a helicopter it is important to be able to grab on to a survivor very quickly and either pull him over the side of the vessel or attach him to a rescue apparatus.

Few suits and no lifejackets currently incorporate such a handhold and thus recovery of a survivor is awkward even for two people.

4.7.3 Historical Incidents

The study team examined a number of marine distress incidents which have occurred off the East Coast of Canada. These incidents involved fishing vessels, pleasure craft and commercial vessels. The scope of this study precludes a description of the incidents examined but there appear to be several common factors which contribute to a successful rescue.

These factors can be summarized as follows:

- The presence of locator devices such as ELT's or EPIRB's can contribute significantly to the success of a rescue operation.

- The most successful rescues alerted the SAR system immediately. The least successful were either reports of overdue vessels or the result of a long delay in alerting the SAR system.
- The most successful rescues had good communications between the various rescue resources and between the rescuers and the survivors.
- Almost invariably the most successful rescues involved those who stayed with the vessel as long as was possible.
- In one case, when two major incidents occurred simultaneously the SAR system was not able to cope with both of them.
- Private searches which are unknown to the SAR system have created a dangerous situation and a duplication of effort.

4.7.4 Conclusions

1) The current techniques/equipment for locating survivors in the water are inadequate under conditions of poor visibility.
2) Recovery of a survivor from the water is difficult due to the design of survival equipment.
3) Locator devices such as ELT's and EPRIB's are effective localization devices.
4) Early alerting of the SAR system is essential.
5) Good communications during a SAR operation is essential.
6) Survivors who stay with the vessel as long as possible have a greater chance of being rescued.

7) The SAR system has problems coping with more than one major incident at a time.

8) Coordination of search and rescue operations between private groups and the SAR system is essential.

The study group also arrived at some general conclusions based upon their examination of marine incidents. These conclusions, although not related to SAR operations, are felt to be relevant to safety in general.

9) Many errors are repeated from one disaster to another and many recommendations of offical inquiries are repetitious.

10) There appears to be no systematic monitoring or follow-up mechanism to ensure that the recommendations of inquiries are implemented.

4.7.5 Recommendations

1) Consideration should be given to incorporating strobe lights or personal locator beacons on survival suits and lifejackets.

2) The use of FLIR should be investigated for SAR equipment.

3) ELT's or EPRIB's should be required on all motorized craft, including lifeboats and liferafts.

4) Survival suits and lifejackets should incorporate hand holds for rescuers.

5) There should be a system for monitoring and ensuring that the recommendations of official inquiries are acted upon.

CHAPTER 5: FUTURE DEVELOPMENTS IN RESCUE CAPABILITY

5.1 Air Developments

The helicopters currently in use for rescue operations off the East Coast of Canada operate under conditions which can severely limit their ability to effect a rescue. Foremost among these limitations are:

- Susceptibility to icing conditions.
- A limited rescue capability at night and in poor weather conditions.
- A limited ability to locate survivors at night and under poor weather conditions.
- Flight planning considerations based upon aircraft performance in the event of a single engine failure.
- A limited radius of action.
- A limited transit speed.

Some of these limitations can be alleviated and in some cases overcome completely by the addition of equipment to existing helicopters or by replacing the existing helicopters with the newest, state-of-the-art aircraft.

The SARCUP helicopter in use by the SAR system and the industry S6 helicopters were both designed in the late 1950's and early 1960's. The Super Puma on the other hand was built in the mid 1970's; and, as a result, the design incorporates some

enhanced capabilities. As was discussed in Section 4.4, the Super Puma is 15-20% faster than the SARCUP and S61, has a better single engine performance, and shows the potential for operations under some icing conditions. However, the replacement of the older SARCUP and S61 helicopters with the newer generation of helicopters will result in only a marginal increase in rescue capability.

In order to warrant fleet replacement, an operator normally awaits a life-cycle change (almost non-existent for DND SAR helicopters, which receive new structural members as required during depot level inspection and repair) or the moment when the aircraft is operationally incapable of performing a task. At this point, a new aircraft with significantly improved performance is chosen.

The decision to replace the SARCUP helicopters will be affected by the availability of a replacement which displays significantly improved performance. Currently, an attractive candidate appears to be the United States Joint Services Advanced Vertical Lift Aircraft (JVX), a tilt rotor, fixed-wing aircraft with hover capability. This will probably go into US Navy service at the end of the 1980's and Canada could opt for a SAR version to replace both the Buffalo aircraft and the SARCUP helicopter in the mid 1990's.

The Bell Helicopters proposal to meet the JVX requirement is a high-wing aircraft with tilt assemblies at the wing-tips

containing shaft turbines, reduction gearboxes, and very large diameter propellers. Performance proposed for the SAR version currently includes:

- 20,000 lb. gross weight
- 12 passengers
- 370 nm radius of action
- 265Kt cruising speed
- low noise
- low downwash

Such an aircraft should include an integrated SAR system developed to incorporate communications, navigation, SAR tactical sensors, information processing and presentation, and automatic flight/approach/hover functions on board.

If successful, the JVX would preclude the need to replace the SARCUP helicopter with marginally improved conventional helicopters, although a heavier lift aircraft comparable to the Hercules or its replacement, may still be required to replace the Buffalo. However, the JVX would sensibly meet all the areas for improvement identified above, and would represent a major improvement in the radius of action and in cruising spped.

The outstanding major deficiency of existing helicopters which vitally affects rescue in night or adverse weather operations is the absence of an automatic flight control system with a Doppler radar that would provide auto-hover. Industry S61's and Supper Pumas are equipped with an automatic flight

control system but do not have a Doppler radar incorporated. The Doppler radar option is available for the SARCUP helicopter, but on is currently under development. This is not expected to be operational until 1987.

Other items which could be incorporated into existing helicopters are an Infra-Red survivor localization sustem, and a homing capability for man-overboard/survival personnel locator beacons. This equipment would greatly improve survivor localization capabilities.

5.2 MARINE DEVELOPMENTS

5.2.1 MODU/Standby Vessel Transfer Systems

Section 3.5.2 discussed the use of cranes and helicopters for transferring personnel from a MODU directly to a standby vessel. These are the only techniques which can be used off the East Coast of Canada at the rpesent time. However, there are several systems which are either in use or are under development in other parts of the world. These include high line transfer systems and flexible or rigid gang bridge systems.

High Line Transfer Systems

There are several line transfer systems currently available, two of which are the Hepburn Stand Off Transfer System and the Rauma-Repola Highline Transfer System.

These are both personnel carriage systems which are suspended on a line from the MODU to the standby/rescue vessel. The line is kept taut with a series of constant tension winching blocks and a hydraulic compensator. A prerequisite to the use of these systems is a standby/rescue vessel capable of dynamic positioning and of keeping station under extreme weather conditions. Space is required on the standby/rescue vessel for the fitting of complex and permanent winching and tensioning equipment. These systems are planned for uses such as normal crew changes and their efficiency and safety under severe environmental conditions remains to be proven. However, these systems may prove to be much more effective than current methods.

Flexible and Rigid Gang Bridges

Flexible and rigid Gang Bridges are in use on production facilities in many areas of the world, but there are currently none in use from MODUs to standby/rescue vessels.

One proposal flexible system consists of a large diameter flexible tube which is suspended from the side of the installation and is fixed at one end to the deck of the standby/rescue vessel. The weight of the flexible tube and the distance that it must be supported over the side of the installation may preclude the use of this sytem on MODUs, but it could have applications on fixed platforms.

As with the high line transfer system, the standby/rescue vessel would have to have dynamic positioning capability as well

as a capability to keep station under extreme environmental conditions. The relative motion between the MODU and the standby/rescue vessel will probably restrict the use of this system under extreme conditions.

5.2.2 Lifeboat and Liferaft Recovery Systems

Although it has been stated that persons can survive in a TEMPSC for an extended period of time, even under extreme conditions, consideration must be given to the recovery of survivors from these craft. Circumstances such as damage to the craft, injuries to survivors, or other factors may dictate that persons be rescued under extreme conditions.

The study team is not aware of any systems in use of under development which can safely recover survivors from a lifeboat or liferaft without the survivors being required to leave the craft.

It is the opinion of the study team that, if survivors are to be successfully rescued from these craft under extreme conditions, a system or systems whereby the entire craft and its survivors can be recovered from the water to the rescue vessel.

5.2.3 FRC Launch and Recovery Systems

Several systems for the launch and recovery of fast rescue boats were discussed in Section 4.5.2. The systems discussed are all in use and can be installed on most vessels. There are two additional systems of which the Study Team is aware that were not discussed.

One system, the Abas/Tenvig System is currently under development in Scandanavia. It involves a flexible floating dock or cradle which has the same motion characteristics as the waves that it floats on. It is secured by heave compensated wires to the side of the mother ship but is independent of its motion. The FRC enters the cradle and the FRC and cradle are quickly hoisted clear of the waves. There are no special attachments or quick release hooks and many configurations of craft can be reclaimed. This system also has some potential for the recovery of lifeboats and liferafts and its development and testing should be persued.

The second system, the Slipper System, involves more a change in the standby/rescue vessel design than of lifting equipment. The West German Lifeboat Service has designed one of their rescue vessels with this system. The Slipper System consists of an inclined ramp fitted with horizontal rollers in the stern of the vessel. The rescue craft is recovered simply by driving it up the ramp under its own power. The main advantage to this system is that is dispenses with the need to make a connection to the fast rescue craft; however, the ability to recover the fast rescue craft may be limited by the motion of the standby vessel.

This system is not compatable with the design of standby vessels currently in use, but it may be worthy of consideration on purpose built rescue vessels.

CHAPTER 6: SUMMARY AND GENERAL CONCLUSIONS

From the examination of the resources available to both Government and Industry, it is apparent that an effective search and rescue system can be developed for the offshore oil and gas industry. Improvements are required in the present system in many areas, but the basic resources which are required are already in place. Some of the more important improvements which are required are:

- The development of helicopter immersion suits which provide protection from hypothermia for 3 to 4 hours.
- A single dedicated standby/rescue helicopter at all times for the Grand Banks, during the winter months for the Scotian Shelf and, during the summer months, for the Labrador Coast.
- Ensuring that the standby/rescue helicopters have rescue capability at least equal to that of SAR helicopters.
- Ensuring that standby vessels are properly equipped and their crews are properly trained to carry out their standby role.

The study team feels that if the improvements recommended in Chapter 4 are incorporated into the present system, an adequate search and rescue service would be provided to the oil industry. There are, however, some concerns with the system which the study group did not identify in Chapter 4.

One area of concern is the apparent lack of coordination between Government and Industry regarding Search and Rescue. The SAR system has developed a Major Marine Disaster Plan which is designed to deal with large scale marine disasters. An incident such as the loss of a MODU would certainly qualify as such a disaster, yet the oil industry has not been consulted in the development of this plan. In addition, the MODUs operating off the East Coast of Canada represent a valuable resource to the SAR system. SAR helicopters can be refuelled at these rigs, and industry resources can be tasked to SAR during emergencies.

From the oil industry side, the SAR system does not seem to have been consulted in the development of Joint Alert Plans or contingency plans, yet these plans all include the notification of SAR during an emergency.

The study team feels that is is essential that the SAR system and industry cooperate fully if an effective search, and rescue capability is to be developed for this activity.

Another area of concern is the apparent lack of priority given to SAR by the Government of Canada. The funding structure for the SAR system is not condusive to the development of an effective system, as evidenced by the lack of new technology and equipment present on SAR vessels and aircraft.

Th Report on an Evaluation of Search and Rescue in 1982 made 58 recommendations on how to improve the SAR system to the Government of Canada. These recommendations were accepted, yet many have still to be implemented.

There appears to be a lack of a clear mandate for the SAR system. Although the responsibilities and objectives of the SAR system were outlined in Chapter 2, many of these have yet to receive ministerial approval; and none clearly define the levels of service that the system should provide.

The SAR system appears to operate on the basis of doing the best it can with the resources that it has available (especially in the case of air resources). What is needed, in the opinion of the study team, is for the levels of service to be developed for the SAR system and for equipment and manpower to be allocated to meet those levels of service.

The study team feels that the proposed separate funding structure and proposed strengthening of ICSAR is a positive step towards the development of a more effective SAR system but that further steps must be taken to make the management of the SAR system a separate entity which is divorced from the conflicts of interest with other government departments which presently exist.

An area of concern which has been discussed to some extent in the study but which deserves further comment is the training of marine and air personnel.

No comment can be made as to the training received by the CCG personnel who man the inshore rescue boats, but some additional comment is required on the personnel who man the four large primary SAR vessels. These vessels are dedicated to search and rescue, and yet no special training for this funcion appears to be required for the vessel crews. Similarly, the crews of stnadby vessels in Canada do not receive special training in search and rescue beyond that which is given to the Fast Rescue Boat Crews. CCG SAR-vessel crews do not receive Fast Rescue Boat training.

The provision of rescue training for the entire crews of the SAR vessels and of the industry standby vessels should be given a high priority.

The training of SAR air crews was judged to be adequate by the study team. The crews of SAR helicopters undergo an extensive on-the-job training. The concern here is whether it is practical to demand civilian helicopter crews to perform the same tasks.

The study team does not feel that it is practical to train all of the industry helicopter crews to perform search and rescue operations of the same type as are performed by the SAR system (ie. hoisting with a horsecollar and an SAR TECH). The problem of training industry helicopter crews, along with the special equipment which is required on SAR helicopters, has lead the study team to recommend that dedicated helicopters, which are outfitted for SAR and which have fully trained crews, be contracted to service the oil industry.

Contracted SAR helicopters would not only service the oil industry but would be a valuable addition to Canada's overall search and rescue capability. The training of the crews of these helicopters and the SAR equipment which is placed upon them should be developed in close conjunction with the SAR system as it is the only source of helicopter search and rescue expertise in Canada. For these reasons, the study team strongly recommends that the responsibility for providing a standby/rescue helicopter be taken out of the hands of the oil industry and that this responsibility be placed with an appropriate agency of the Government of Canada such as COGLA. The study team, however, does recommend that the oil industry continue to be responsible for the financing of these aircraft as their primary function would be to service this industry.

In summary, the study team feels that an effective search and rescue system can be developed for the offshore oil industry in Canada. A great deal of coordination and cooperation between the oil industry and the SAR system will be required, especially when production of oil and gas off Canada's East Coast becomes a reality. Planning for the production phase of this activity should begin as early as possible.

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